BLM

MONTANA

Draft Supplement to the Montana Statewide Oil and Gas Environmental Impact Statement and Amendment of the Powder River and Billings Resource Management Plans

VOLUME II

December 2006

Miles City Field Office

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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The Bureau of Land Management is responsible for the stewardship of our public lands. It is committed to manage, protect, and improve these lands in a manner to serve the needs of the American people for all times. Management is based on the principles of multiple use and sustained yield of our nation's resources within a framework of environmental responsibility and scientific technology. These resources include recreation; rangelands; timber; minerals; watershed; fish and wildlife; wilderness; air; and scenic, scientific, and cultural values.

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AIR QUALITY MODELING APPENDIX

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This appendix contains the Air Quality Modeling Appendix included in the 2003 EIS (Air Quality Modeling Appendix – Part 1) and the Air Quality Modeling Report for the recently (2006) completed air modeling conducted for the SEIS (Air Quality Modeling Appendix - Part 2). The SEIS Air Modeling Appendix - Part 2 contains attachments for information on Health Effects and Mitigation Measures.

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AIR QUALITY MODELING APPENDIX – PART 1

QUANTITATIVE REVIEW OF

AMBIENT AIR QUALITY IMPACTS

Final Oil and Gas Environmental Impact Statement and Amendment of the Powder River and Billings Resource Management Plans

Prepared for

U.S. BUREAU OF LAND MANAGEMENT
Miles City Field Office
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January 2003

2003 EIS AIR QUALITY MODELING APPENDIX

Air Quality Impact Technical Support Document

The following technical support document describes the processes used to conduct the air quality impact assessment, and provides summaries of relevant analysis data:

Argonne National Laboratory.
2002. Technical Support Document - Air Quality Impact Assessment for the Montana Statewide Final Oil and Gas EIS and Amendment of the Powder River and Billings Resource Management Plans and the Wyoming Final EIS and Planning Amendment for the Powder River Basin Oil and Gas Development Project. Prepared for the U.S. Department of the Interior, Bureau of Land Management, Montana and Wyoming State Offices, by the Environmental Assessment Division, Argonne National Laboratory. Argonne, Illinois.

Copies of this technical support document are available upon request from:

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1.0 Introduction

Air pollution impacts are limited by local, state, tribal and federal air quality regulations, standards, and implementation plans established under the CAA and administered by the MDEQ and the EPA. Although not applicable to the proposed Alternatives, the WYDEQ has similar jurisdiction over potential air pollutant emission sources in Wyoming, which can have a cumulative impact with MDEQ approved sources. Air quality regulations require certain proposed new, or modified existing, air pollutant emission sources (including CBM compression facilities) undergo a permitting review before their construction can begin. Therefore, the applicable air quality regulatory agencies have the primary authority and responsibility to review permit applications and to require emission permits, fees and control devices, prior to construction and/or operation.

Fugitive dust and exhaust from construction activities, along with air pollutants emitted during operation (i.e., well operations, field [booster] and sales [pipeline] compressor engines, etc.), are potential causes of air quality impacts. These issues are more likely to generate public concern where natural gas development activities occur near residential areas. The FS, NPS, and the FWS have also expressed concerns regarding potential atmospheric deposition (acid rain) and visibility impacts within distant downwind PSD Class I and PSD Class II areas under their administration, located throughout Montana, Wyoming, southwestern North Dakota, western South Dakota, and northwestern Nebraska.

2.0 Existing Air Quality

As described in **Chapter 3 - Affected Environment (Air Quality)**, specific air quality monitoring is not conducted throughout most of the CBM emphasis area, but air quality conditions are likely to be very good, as characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions, resulting in relatively low air pollutant concentrations. Air quality monitoring is the appropriate tool for determining compliance with the NAAQS for both particulate matter with an aerodynamic diameter equal to or less than ten microns in diameter (PM_{10}) and nitrogen dioxide (NO_2). As part of the Air Quality Impact Assessment prepared by Argonne National Laboratory (Argonne 2002), monitoring data measured throughout the southeastern Montana and northeastern Wyoming were assembled and reviewed. Although monitoring is primarily conducted in urban or industrial areas, the data selected are considered to be the best available representation of background air pollutant concentrations throughout the CBM emphasis area. Specific values presented in Table AQ-1 were used to define background conditions in the air quality impact analysis. The selected background pollutant concentrations are below applicable ambient air quality standards for all pollutants and averaging times. These National and Montana standards, and the PSD increment values, are also presented in Table AQ-1.

TABLE AQ-1
ASSUMED BACKGROUND CONCENTRATIONS, APPLICABLE AMBIENT AIR QUALITY STANDARDS, AND PSD INCREMENT VALUES (IN (μG/M³)

Pollutant	Averaging Time [a]	Background Concentration	National Ambient Air Quality Standards	Montana Ambient Air Quality Standards	PSD Class I Increment	PSD Class II Increment
Carbon Monoxide	1-hour	15,000	40,000	40,000	N/A	N/A
	8-hours	6,600	10,000	10,000	N/A	N/A
Lead	Quarterly	N/A	1.5	1.5	N/A	N/A
Nitrogen Dioxide	1-hour	117	N/A	566	N/A	N/A
	Annual	11	100	100	2.5	25
Ozone	1-hour	N/A	235	196	N/A	N/A
	8-hours	100	157	N/A	N/A	N/A
$PM_{2.5}$	24-hours	20	65	N/A	N/A	N/A
	Annual	8	15	N/A	N/A	N/A
PM_{10}	24-hours	105	150	150	8	30
	Annual	30	50	50	4	17
Sulfur Dioxide	1-hour	666	N/A	1,300	N/A	N/A
	3-hours	291	1,300	N/A	25	512
	24-hours	73	365	260	5	91
	Annual	16	80	60	2	20

Source: Argonne (2002)
Notes:
μg/m³ - micrograms per cubic meter
[a] Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.
N/A – data not available

Note that for evaluating consumption of the PM_{10} and NO_2 increments in Montana and Wyoming, as well as on Indian Reservations, modeling performed by an air quality regulatory agency is the appropriate tool (emissions solely from surface coal mines being the only exception). It should be noted that the BLM model used to identify and analyze impacts in this EIS is not intended or designed to be a regulatory PSD increment consumption modeling process.

Monitoring should be used to supplement modeling efforts, to:

1. Determine if identified levels of concern are exceeded, triggering the need to implement additional mitigation measures in order to avoid regulatory action
2. Provide additional indication of the need for regulatory modeling to determine if increments are being exceeded and an updated State Implementation Plan needed

The States of Wyoming and Montana will work with EPA to develop monitoring plans, which will consider population areas, modeled hot spots and other potential areas of concern. EPA will work with the Crow Tribe and Northern Cheyenne Tribe to identify the need for and to deploy additional monitoring as needed. The EIS predicts that full

development of the Coal Bed Methane resource in Montana, in culmination with non-project and RFFA sources, may generate criteria air pollutants (PM, VOCs and NOx) in sufficient quantities to require regulatory action on the part of MDEQ to protect both the PSD increments and the Montana and National Ambient Air Quality Standards. MDEQ will need to accurately predict the impacts of proposed projects during the New Source Review process and assure that both the ambient standards and the increments are protected. Once projects are up and running MDEQ will also require ambient monitoring data from appropriately sited monitors to verify the permit analysis projections and provide a feedback loop of current ambient data to make sure that future permitting decisions continue to protect the standards and increments. MDEQ can and will require ambient monitoring as a permit condition for major sources.

Additionally, much of the permit analysis for sources of this nature requires good ambient data to accurately predict project impacts. Permitting sources of NO_2 and Ozone (O_3-) precursors (VOCs)~~)~~, requires representative monitoring data to adequately analyze the expected impact of new emissions. Prediction of NO_2 is highly dependant on some knowledge of NO to NO_2 conversion rates. This information is supposed to come from either an analysis of actual NO/NO_2 ratios determined by monitoring results (preferred method), the use of a default value (very conservative and has recently resulted in predicted violations of the annual standard), or by the use of ambient Ozone data to predict conversion rates. Permitting large VOC sources raises similar questions. Ozone analysis requires at least some knowledge of atmospheric chemistry conversion rates in the area of analysis. At this time MDEQ does not have reliable data on the actual chemistry that is occurring in the development area and doesn't have any reliable background Ozone values.

Therefore, MDEQ will need NO/NO_2, O_3 and PM data for the development area from a regionally scaled ambient monitoring station. MDEQ has reviewed the modeling done for the EIS and a monitor sited in the Birney/Ashland area would be the best choice. Provided that funds become available, MDEQ would establish and maintain a monitoring station in this area.

It is important that monitors be deployed before CBM development occurs, or as early in the development cycle as possible, in order to provide baseline information and trend data.

3.0 Regulatory Framework

The National and Montana ambient air quality standards set the absolute upper limits for specific air pollutant concentrations at all locations where the public has access. The analysis of the proposed Alternatives must demonstrate continued compliance with all applicable local, state, tribal and federal air quality standards. Existing air quality throughout most of the CBM emphasis area is in attainment with all ambient air quality standards, as demonstrated by the relatively low concentration levels presented in Table AQ-1. However, three areas have been designated as federal nonattainment areas where the applicable standards have been violated in the past: Lame Deer (PM_{10} - moderate) and Laurel (sulfur dioxide (SO_2) - primary), Montana; and Sheridan, Wyoming (PM_{10} - moderate). Specific monitoring data collected by the Northern Cheyenne Tribe are presented in Table AQ-2.

Air quality regulations require certain proposed new, or modified existing, air pollutant emission sources (including CBM compression facilities) to undergo a permitting review before their construction can begin. Therefore, the applicable air quality regulatory agencies have the primary authority and responsibility to review permit applications and to require emission permits, fees and control devices, prior to construction and/or operation. In addition, the U.S. Congress (through the CAA Section 116) authorized local, state and tribal air quality regulatory agencies to establish air pollution control requirements more (but not less) stringent than federal requirements. Also, under FLPMA and the CAA, BLM cannot authorize any activity which would not conform to all applicable local, state, tribal and federal air quality laws, regulations, standards, and implementation plans.

Given most the CBM emphasis area's current attainment status, future development projects which have the potential to emit more than 250 tons per year of any criteria pollutant (or certain listed sources that have the potential to emit more than 100 tons per year) would be required to undergo a site-specific regulatory PSD Increment Consumption analysis under the federal New Source Review and permitting regulations. Development projects subject to the PSD regulations may also be required by the applicable air quality regulatory agencies to incorporate additional emission control measures (including a BACT analysis and determination) to ensure protection of air quality resources, and demonstrate that the combined impacts of all PSD sources will not exceed

the allowable incremental air quality impacts for NO_2, PM_{10}, and SO_2.

The NEPA analysis compares potential air quality impacts from the proposed alternatives to applicable ambient air quality standards and PSD increments, but comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern for potential impacts, and do not represent a regulatory PSD Increment Consumption Analysis. Even though most of the development activities would occur within areas designated PSD Class II, the potential impacts on regional Class I areas are to be evaluated. The Montana DEQ will perform the required regulatory PSD increment analysis during the new sources review process. This formal regulatory process will include analysis of impacts on Class I and II air quality areas by existing and proposed emission sources. The activities are not allowed to cause incremental effects greater than the stringent Class I thresholds to occur inside any PSD Class I Area. Stringent emission controls (BACT – Best Available Control Technology) and emission limits may be stipulated in air quality permits as a result of this review, or a permit could be denied.

Sources subject to the PSD permit review procedure are also required to demonstrate potential impacts to air quality related values (AQRV). These include visibility impacts, degradation of mountain lakes from atmospheric deposition (acid rain), and effects on sensitive flora and fauna in the Class I areas. The CAA also provides specific visibility protection procedures for the mandatory federal Class I areas designated by the U.S. Congress on August 7, 1977, which included wilderness areas greater than 5,000 acres in size, and national parks and national memorial parks greater than 6,000 acres in size as of that date. The Fort Peck and Northern Cheyenne tribes have also designated their lands as PSD Class I, although the national visibility regulations do not apply in these areas. The allowable incremental impacts for NO_2, PM_{10}, and SO_2 within these PSD Class I areas are very limited. The remainder of the CBM emphasis area is designated PSD Class II with less stringent requirements.

TABLE AQ-2
AMBIENT AIR QUALITY MONITORING DATA COLLECTED BY THE NORTHERN CHEYENNE TRIBE (IN ($\mu G/M^3$)

Pollutant	Averaging Time [a]	Year	Morningstar	Garfield Peak	Badger Peak	Lame Deer # 1	Lame Deer # 2	Lame Deer # 3	Lame Deer "PM10A"	Lame Deer "TEOM"
nitrogen dioxide	Annual	1996	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		1997	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		1998	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		1999	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		2000	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
PM_{10}	Annual	1996	6	N/A	N/A	20	N/A	N/A	N/A	N/A
		1997	N/A	N/A	N/A	18	26	N/A	N/A	N/A
		1998	N/A	N/A	N/A	23	32	32	N/A	N/A
		1999	N/A	N/A	N/A	19	33	32	[22] [b]	32 [b]
		2000	N/A	N/A	N/A	18	29	N/A	17 [b]	28 [b]
		2001	N/A	N/A	N/A	16	36	N/A	N/A	N/A
	24-hours	1996	19	N/A	N/A	120	N/A	N/A	N/A	N/A
		1997	N/A	N/A	N/A	106	75	N/A	N/A	N/A
		1998	N/A	N/A	N/A	55	**153**	**153**	N/A	N/A
		1999	N/A	N/A	N/A	41	106	107	[36] [b]	93 [b]
		2000	N/A	N/A	N/A	40	124	N/A	39 [b]	93 [b]
		2001	N/A	N/A	N/A	33	135	N/A	N/A	N/A

TABLE AQ-2
AMBIENT AIR QUALITY MONITORING DATA COLLECTED BY THE NORTHERN CHEYENNE TRIBE (IN (µG/M^3)

Pollutant	Averaging Time [a]	Year	Morningstar	Garfield Peak	Badger Peak	Lame Deer # 1	Lame Deer # 2	Lame Deer # 3	Lame Deer "PM10A"	Lame Deer "TEOM"
sulfur dioxide	Annual	1996	2.7	2.7	2.7	N/A	N/A	N/A	N/A	N/A
		1997	2.7	2.7	2.7	N/A	N/A	N/A	N/A	N/A
		1998	2.7	2.7	2.7	N/A	N/A	N/A	N/A	N/A
		1999	2.7	2.7	2.7	N/A	N/A	N/A	N/A	N/A
		2000	2.7	2.7	2.7	N/A	N/A	N/A	N/A	N/A
	24-hours	1996	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		1997	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		1998	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		1999	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
		2000	5.7	5.7	5.7	N/A	N/A	N/A	N/A	N/A
	3-hours	1996	5.2	7.8	5.2	N/A	N/A	N/A	N/A	N/A
		1997	5.2	7.8	5.2	N/A	N/A	N/A	N/A	N/A
		1998	10.4	10.4	10.4	N/A	N/A	N/A	N/A	N/A
		1999	7.8	7.8	5.2	N/A	N/A	N/A	N/A	N/A
		2000	5.2	5.2	5.2	N/A	N/A	N/A	N/A	N/A

Source: EPA (2002b)

Notes: µg/m^3 - micrograms per cubic meter
N/A - data not available
[a] Short-term averages are reported as the second maximum values.
[b] Supplemental data provided by (Littlewolf 2002).

[data] - data in brackets are not reliable due to the small number of samples collected.

4.0 Agency Roles and Authorities

4.1 Environmental Protection Agency

The Environmental Protection Agency (EPA) administers the Federal Clean Air Act (CAA), (42 U.S.C. 7401 et seq.) to maintain the National Ambient Air Quality Standards (NAAQS) that protect human health and to preserve the rural air quality in the region by assuring the Prevention of Significant Deterioration Class I and Class II increments for SO_2, NO_2, and PM_{10}, are not exceeded. EPA has delegated this CAA authority to the States of Montana and Wyoming.

Until the Tribes have an EPA-approved Tribal program, EPA will administer air quality requirements within Indian country. EPA is responsible for assuring that NAAQS are attained and that the Tribally-designated Northern Cheyenne Class I sensitive airshed is protected, as well as the Class II increment limits that apply on the Crow Reservation. EPA will implement an air permitting program for major sources within Indian country, including BACT analysis, where appropriate. At this time, there is no federal minor source permitting program. Therefore, EPA cannot regulate minor sources in Indian country directly unless EPA decides to implement a Federal Implementation Plan (FIP). Mitigation of particulate emissions from unimproved roads in Indian country may be necessary to protect the Class I and Class II PM_{10} increments.

4.2 Montana DEQ

The MDEQ has been delegated Federal Clean Air Act (CAA) authority from the United States Environmental Protection Agency (EPA) to manage the New Source Review—Prevention of Significant Deterioration (PSD) permit program for listed major sources with the potential to emit (PTE) greater than 100 tons per year (tpy) of any regulated pollutant and all other sources with a PTE greater than 250 tpy of any regulated pollutant. Further, the MDEQ, under the Clean Air Act of Montana (MCA 75-2-101 et seq.) and the Administrative Rules of Montana (ARM) administers a minor source air quality permitting program for sources with a PTE greater than 25 tons per year unless otherwise noted in the ARM. This program requires, among other things, that Best Available Control Technology (BACT) apply to regulated air pollutant emission sources. MDEQ also has delegated responsibility to operate an approved ambient air quality monitoring network for the purpose of demonstrating compliance with the National and Montana Ambient Air Quality Standards (NAAQS/ MAAQS).

Currently, the MDEQ imposes a minor source permit limitation on gas compressor engines on a permit-by-permit basis for sources exceeding the Montana minor source permitting threshold (ARM Chapter 17.8, Subchapter 7). Under the authority of ARM 17.8.715, Emission Control Requirements, the MDEQ establishes BACT on a case-by-case basis for natural gas compressor engines, such as those sources indicated for coal bed methane (CBM) development. In general, the Department has required NO_2 emission limits of around 2 grams per brake horsepower hour (g/bhp-hr), a CO emission limit of around 3 g/bhp-hr, and a volatile organic compound (VOC) emission limit of around 1 g/bhp-hr for these sources. Again, as part of the minor source permitting program, Montana applies pollutant specific BACT to compressor engines on a case-by-case basis with limits as described above. However, should future regulatory modeling indicate potential NAAQS/MAAQS or increment consumption exceedances, the MDEQ may require more stringent limits to protect applicable standards.

In addition to the applicable point source BACT emission limits described above, under the authority of ARM 17.8.308, the MDEQ requires that a permitted source use reasonable precautions to limit fugitive particulate emissions from haul roads, access roads, parking lots, or the general plant property. In general, the MDEQ requires that a source have fresh water and/or chemical dust suppressant available on site and used as necessary to maintain compliance with applicable limits, including, but not limited to, the reasonable precautions and opacity limits. Further, the MDEQ could establish more stringent BACT limits for permitted sources and require that counties apply BACM to unimproved roads or other control measures sufficient to avoid exceeding applicable standards and the Class I and Class II increment limits for PM_{10}. Further, the ARM establishes generally applicable air quality rules pertaining to all sources of air pollution, including sources not subject to air quality permitting. These rules include, but are not limited to, the requirements contained in ARM 17.8, Subchapter 1 and ARM 17.8, Subchapter 3.

4.3 Bureau of Indian Affairs

BIA is responsible for approval of any lease, agreement, permit, or document that could encumber lands and minerals owned by either Tribes or allottees. Under the Indian Mineral Development Act (IMDA),

the Secretary of Interior is responsible, based upon BIA recommendation, for approving any contractual arrangement to develop CBM resources. Specific discussion of tribal air quality management issues are addressed separately.

4.4 Bureau of Land Management

NEPA requires that federal agencies consider mitigation of direct and cumulative impacts during their preparation of an EIS. (BLM Land Use Planning Manual 1601.) Under the CAA, federal agencies are to comply with State Implementation Plans regarding the control and abatement of air pollution. Prior to approval of Resource Management Plans (RMPs) or Amendments to RMPs, the State Director is to submit any known inconsistencies with State Implementation Plan (SIP) to the Governor of that state. If the Governor of the State recommends changes in the proposed RMP or Amendment to meet SIP requirements, the State Director shall provide the public an opportunity to comment on those recommendations. (BLM Land Use Planning Manual at Section 1610.3-2.)

4.5 Forest Service

The Forest Service administers nine wilderness areas (WAs) that could be affected by direct effects associated with project and non-project sources: Bridger WA; Fitzpatrick WA; North Absaroka, Absaroka-Beartooth, and Washakie WAs, next to Yellowstone NP; Teton WA; U.L. Bend WA; Cloud Peak WA; and Popo Agie WA with mandatory Class I designation. As federal land mangers, the Forest Service could act in a consultative role to stipulate that the BLM modeling results, or any future EPA or State-administered PSD refined modeling results (if justified), triggers adverse impairment status. Should the Forest Service determine impairment of WAs, then BLM, the State, and/or EPA may need to mitigate this predicted adverse air quality effect.

4.6 National Park Service

Three areas administered by the National Park Service—Yellowstone National Park, Devils Tower National Monument, and Bighorn Canyon National Recreation Area—could be affected by direct effects associated with project and non-project sources. (Note: Additional Park Service Class I and II areas may be impacted by the non-project sources evaluated, without significant impact from project sources.) As federal land mangers, the Park Service could act in a consultative role to stipulate that the BLM modeling results, or any future EPA or State-administered PSD refined modeling results (if justified), triggers adverse impairment status. Should the Park Service determine impairment of NPS-administered Class I areas, then BLM, the State, and/or EPA may need to mitigate this predicted adverse air quality effect.

5.0 Air Quality Management on Tribal Lands

The 1990 Clean Air Act (CAA) Amendments (Section 301(d)) provided tribes the authority to implement CAA programs for their reservations. The Tribal Authority Rule (TAR), promulgated February 12, 1998, reiterates that tribes have direct implementation authority for the CAA. However, until such time as the tribe assumes such responsibility to implement its own program, EPA must implement Federal air quality laws for them. The TAR also requires under §49.11 that EPA promulgate a Federal Implementation Plan (FIP) as necessary or appropriate to protect air quality on the reservations.

EPA has the authority to implement two permitting programs and three source specific programs. EPA has regulatory authority to issue pre-construction permits to major air pollution emissions sources under the Prevention of Significant Deterioration (PSD) program at 40 CFR part 52 and operating permits to major sources under the Title V program at 40 CFR part 71. The PSD program requires that subject sources conduct an air quality analysis to determine the impact on the National Ambient Air Quality Standards (NAAQS) and the PSD increments for NO_2, SO_2, and PM_{10} for three different area classifications (Class I, Class II, and Class III). Under the PSD program, Class I status was assigned to pristine areas, such as national parks and forest lands. Several tribes have been redesignated from a Class II status to a Class I status. The rest of the country is Class II and there are no Class III areas. EPA also has regulatory authority to implement the New Source Performance Standards (NSPS) at 40 CFR part 60, the National Emission Standards for Hazardous Air Pollutants (NESHAP) at 40 CFR part 61, and the Maximum Achievable Control Technology (MACT) standards at 40 CFR part 63.

EPA does not have a rule for a minor source pre-construction permitting program for permitting new and modified sources. A minor source rule is being addressed by the Agency, but such a rule will not be final for 2-3 years. A minor source rule could give EPA the authority to implement a minor source Best Available Control Technology (BACT) requirement for engines. Nor does EPA have a FIP in place for Indian

country to address measures for controlling fugitive dust or control technologies for engines.

In 1977, the Northern Cheyenne Indian Tribe's Reservation was redesignated as a Class I airshed under the PSD program. The Tribe has implemented an air quality monitoring program, delivering air quality data to AIRS-AQS since 1981. Currently, the Tribe does not have any EPA approved CAA programs for issuing permits, nor is there a Tribal Implementation Plan (TIP) with general source or source specific requirements or any of the federal NSPS, MACT, or NESHAP standards. At this time, if permitting of major air pollution sources was required, EPA would be the permitting authority.

The Crow Indian Reservation is a Class II airshed. Currently, the Tribe does not have any EPA approved CAA programs for issuing permits, nor is there a TIP with general source or source specific requirements, or any of the federal NSPS, MACT, or NESHAP standards. The Tribe was approved for a CAA Section 103 grant in 2001 to conduct an emissions inventory of the sources on the Reservation. The Tribe is not currently implementing an air quality monitoring program. At this time, if permitting of major air pollution sources were required, EPA would be the permitting authority.

The preferred method to determine the mitigation required to prevent exceedances of ambient air quality standards and to prevent significant deterioration is modeling. EPA will work with the states of Wyoming and Montana along with the tribes to see that, wherever possible, tribal air quality issues are addressed in regional modeling efforts related to coal bed methane development. Additional modeling efforts addressing specific tribal concerns, as necessary, can be undertaken by EPA and the tribal air quality agencies.

Ambient air monitoring can be used to augment and validate modeled results. The Northern Cheyenne Tribe currently conducts ambient air PM_{10} and particulate matter with an aerodynamic diameter equal to or less than 2.5 microns ($PM_{2.5}$) monitoring in the Lame Deer PM_{10} non-attainment area on the Northern Cheyenne Reservation. In order to track the impacts of nearby industrial activities on air quality, the tribe also conducts IMPROVE protocol speciated $PM_{2.5}$ monitoring at the Morningstar site, and PM_{10}, SO_2 and NO_2 monitoring at the Morningstar, Badger Peak and Garfield Peak monitoring stations. These monitoring stations also have collocated meteorological monitors. With updates to emission inventories as a result of coal bed methane development on or outside the Northern Cheyenne Reservation, the monitoring network may need revision or augmentation.

The Crow Tribe does not currently have an air monitoring program and has never had one that submitted data to AIRS-AQS. The Crow tribe has the same rights and potential capabilities as the Northern Cheyenne Tribe. If regional emission increases are sufficient to threaten the NAAQS or other relevant air quality standard on Crow lands, EPA would work with the tribe to encourage them to initiate monitoring activities. To this end, the Tribe can build the capability necessary to conduct ambient air quality monitoring. In the event the tribe chooses not to conduct monitoring, EPA can choose to conduct monitoring using either EPA personnel or contract assistance under Section 301 of the Clean Air Act.

In addition to point source emissions, fugitive dust controls for coal bed methane sources will likely be needed for development on tribal lands. The Tribes can use contractual relationships with developers to require necessary construction phase dust controls on wells on Tribal lands. EPA will work with Tribal, BIA and county agencies as needed to develop and implement necessary mitigation on unpaved roads used for development related traffic.

6.0 Air Quality Impact Assessment

As described in **Chapter 4, Environmental Consequences (Air Quality)**, an extensive air quality impact assessment technical support document was prepared by Argonne National Laboratory (Argonne 2002) and is available for review. Argonne analyzed potential impacts from: individual proposed Alternatives A, B/C/E, and D (project sources); "Non-project" emission sources (existing sources, RFFA and Wyoming PRBO&G Alternative 1; RFFA emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest; and all sources cumulatively by Alternative. Since Alternatives B, C and E have very similar emission inventories, a single air quality impact analysis represents all of these three Alternatives. For example, under Alternative C the number of wells connected to a field (booster) compressor would not be limited but the number was assumed to be the same as in Alternative B, and under Alternative E electrical field (booster) compressors would be required where noise is an issue although all compressors were assumed to be gas-fired.

The air quality impact assessment was based on the best available engineering data and assumptions, meteorology data, and dispersion modeling procedures,

as well as professional and scientific judgment. However, where specific data or procedures were not available, reasonable assumptions were made. Note that these assumptions could result in under or over-estimates of impacts. It is difficult to ascertain the overall bias of the emission estimates and modeling; no sensitivity or probabilities of occurrence analyses were performed.

Air quality impacts for various air pollutants are determined by the use of air dispersion models using specific source emission rates. For natural gas compressors, the emissions of nitrogen oxides are determined by the assumed permitted emission rate allowed by the state. For fugitive dust impacts, emission rates are obtained from EPA's AP-42 document that is titled "Compilation of Air Pollutant Emission Factors". An AP-42 emission factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. Emission factors may be appropriate to use in a number of situations such as making source-specific emission estimates for area-wide inventories. These inventories have many purposes including ambient dispersion modeling and analysis, control strategy development, and in screening sources for compliance investigations. In most cases, these factors are simply averages of all available data of acceptable quality, and are generally assumed to be representative of long-term averages for all sources in a specific category.

Potential air pollutant emissions from the proposed Alternatives emission sources (denoted as "project" sources) were calculated separately to determine potential impacts. These emissions were then combined with existing sources, proposed non-PRBO&G developments and reasonably foreseeable future actions (RFFA) emissions (denoted as "non-project" sources) and RFFA emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest to determine the total potential cumulative air quality impacts. All of the tables in this Air Quality Modeling Appendix display impacts from: 1) the project sources only; 2) the project sources combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest (denoted as "Project + RFFA Sources); 3) the non-project sources; and 4) cumulative totals.

The non-project sources include development permitted: 1) by the MDEQ; 2) by the WYDEQ; and 3) within the states of North Dakota, South Dakota, and Nebraska; and projections for the Wyoming Powder River Basin Oil and Gas Project DEIS Alternative sources (BLM 2002a); and other RFFA sources from states within the geographic area covered by the model.

Potential direct, indirect and cumulative air quality impacts were analyzed and reported solely under the requirements of NEPA, in order to assess and disclose reasonably foreseeable impacts to both the public and the BLM decision maker before a Record of Decision is issued. Due to the preliminary nature of this NEPA analysis, it should be considered a reasonable estimate of predicted impacts. Actual impacts at the time of development (subject to air pollutant emission source permitting) could be different. To the extent that impacts are predicted to be greater than regulatory thresholds, appropriate mitigation efforts would be undertaken.

Given the lack of representative wind measurements throughout the CBM emphasis area, the EPA CALPUFF dispersion model was used with regional wind speed and direction values derived from the 1996 MM5 (mesoscale model) and CALMET meteorological models (Argonne 2002). Meteorological information was assembled to characterize atmospheric transport and dispersion from several 1996 data sources, including: 36 km gridded MM5 (mesoscale model) values with continuous four-dimensional data assimilation; and hourly surface observations (wind speed, wind direction, temperature, cloud cover, ceiling height, surface pressure, relative humidity, and precipitation.)

Potential air quality impacts were predicted using the EPA CALPUFF dispersion model. The meteorology data and air pollutant emission values were combined to predict maximum potential direct, indirect, and cumulative near-field air quality impacts in the vicinity of assumed well and compressor engine emission sources for comparison with applicable air quality standards and PSD Class II increments. Maximum potential near-field particulate matter emissions from traffic on unpaved roads and during well pad construction were used to predict the maximum annual and 24-hour average $PM_{2.5}$, PM_{10}, and SO_2 impacts. Maximum air pollutant emissions from each CBM well would be temporary (i.e., occurring during a 12-day construction period) and would occur in isolation, without significantly interacting with adjacent well locations. Particulate matter emissions from well pad and resource road construction would be minimized by application of water and/or chemical dust suppressants. The control efficiency of these dust suppressants was computed at 50 per cent during construction. During well completion testing, natural gas could be burned (flared) up to 24 hours.

Air pollutant dispersion modeling was also performed to quantify CO, NO_2, $PM_{2.5}$, PM_{10}, and HAP impacts during operation. Operation emissions would primarily occur due to increased compression requirements, including field (booster) and sales (pipeline) compressor stations. Since produced natural gas is nearly pure methane, with little or no liquid hydrocarbons or sulfur compounds, direct VOC emissions or objectionable odors are not likely to occur. HAP impacts were predicted based on an assumed 9,900 horsepower, six-unit, reciprocating compressor engine station operating at full load with emissions generated by a single stack.

The significance criteria for potential air quality impacts include local, state, tribal and federally enforced legal requirements to ensure air pollutant concentrations will remain within specific allowable levels. These requirements and legal limits were presented in Table AQ-1. Where legal limits have not been established, the BLM uses the best available scientific information to identify thresholds of significant adverse impacts. Thresholds have been identified for hazardous air pollutant (HAP) exposure, potential acid neutralizing capacity (ANC) changes to sensitive lake water chemistry, and a 1.0 dv "just noticeable change" in potential visibility impacts.

Since neither the MDEQ nor EPA have established HAP standards, predicted 8-hour HAP concentrations were compared to a range of 8-hour state maximum Acceptable Ambient Concentration Levels (EPA 1997a). Pollutants which were predicted to exceed these state threshold levels were also analyzed to determine the possible incremental cancer-risk for a most likely exposure (MLE) to residents, and to a maximally exposed individual (MEI), such as compressor station workers. These cancer risks were calculated based on the maximum predicted annual concentrations, EPA's unit risk factors for carcinogenic compounds (EPA 1997b), and an adjustment for time spent at home or on the job.

The EPA CALPUFF dispersion model was also used to determine maximum far-field ambient air quality impacts at downwind mandatory federal PSD Class I areas, and other sensitive receptors, to: 1) determine if the PSD Class I increments might be exceeded; 2) calculate potential total sulfur and nitrogen deposition, and their related impacts to in sensitive lakes; and 3) predict potential visibility impacts (regional haze) within distant sensitive receptors.

Several lakes within five FS designated wilderness areas were identified as being sensitive to atmospheric deposition and for which the most recent and complete data have been collected. The FS (Fox et al. 1989) has identified the following total deposition (wet plus dry) thresholds below which no adverse impacts are likely: five kg/ha-yr for sulfur, and three kg/ha-yr for nitrogen. The FS (2000) has also developed a screening method which identifies the following Limit of Acceptable Change regarding potential changes in lake chemistry: no more than a ten per cent change in ANC for those water bodies where the existing ANC is at or above 25 μeq/l, and no more than a one μeq/l change for those extremely sensitive water bodies where the existing ANC is below 25 μeq/l. No sensitive lakes were identified by either the NPS or FWS.

Since the potential air pollutant emission sources constitute many small sources spread out over a very large area, discrete visible plumes are not likely to impact the distant sensitive areas, but the potential for cumulative visibility impacts (increased regional haze) is a concern. Regional haze degradation is caused by fine particles and gases scattering and absorbing light. Potential changes to regional haze are calculated in terms of a perceptible "just noticeable change" (1.0 dv) in visibility when compared to background conditions. A 1.0 dv change is considered potentially significant in mandatory federal PSD Class I areas as described in the EPA Regional Haze Regulations (40 CFR 51.300 et seq.), and as originally presented in Pitchford and Malm (1994). A 1.0 dv change is defined as about a ten per cent change in the extinction coefficient (corresponding to a two to five per cent change in contrast, for black target against a clear sky, at the most optically sensitive distance from an observer), which is a small but noticeable change in haziness under most circumstances when viewing scenes in mandatory federal Class I areas.

It should be noted that a 1.0 dv change is not a "just noticeable change" in all cases for all scenes. Visibility changes less than 1.0 dv are likely to be perceptible in some cases, especially where the scene being viewed is highly sensitive to small amounts of pollution, such as due to preferential forward light scattering. Under other view-specific conditions, such as where the sight path to a scenic feature is less than the maximum visual range, a change greater than 1.0 dv might be required to be a "just noticeable change." However, this NEPA analysis is not designed to predict specific visibility impacts for specific views in specific mandatory federal PSD Class I areas based on specific project designs, but to characterize reasonably foreseeable visibility conditions that are representative of a fairly broad geographic region, based on reasonable emission source assumptions. This approach is consistent with both the nature of regional haze and the requirements of NEPA. At the time of a pre-construction air quality permit review, the applicable air quality regulatory

agency may require a much more detailed visibility impact analysis. Factors such as the magnitude of change, frequency, time of the year, and the meteorological conditions during times when predicted visibility impacts are above the 1.0 dv threshold (as well as inherent conservatism in the modeling analyses) should all be considered when assessing the significance of predicted impacts.

The FS, NPS and FWS have published their “Final FLAG Phase I Report” (Federal Register, Vol. 66 No. 2, dated January 3, 2001), providing “a consistent and predictable process for assessing the impacts of new and existing sources on AQRVs” including visibility. For example, the FLAG report states “A cumulative effects analysis of new growth (defined as all PSD increment-consuming sources) on visibility impairment should be performed,” and further, “If the visibility impairment from the proposed action, in combination with cumulative new source growth, is less than a change in extinction of 10% [1.0 dv] for all time periods, the Federal Land Managers (FLM) will not likely object to the proposed action.”

The FLAG report also recommends a two-step analysis process to evaluate potential visibility impacts from either a single proposed air pollutant emission source (the seasonal FLAG screening method) or potential cumulative visibility impacts from a group of air pollutant emission sources (the daily FLAG refined method). As described in Argonne (2002), this NEPA analysis first used the seasonal FLAG screening method (based on both the FLAG and WYDEQ-AQD “natural background” reference levels) to exclude those sensitive areas where visibility impacts were not likely to occur. Since no areas were excluded using the seasonal FLAG screening method, this NEPA analysis then applied the daily FLAG refined method (based on hourly background optical extinction and relative humidity values measured in both the Badlands and Bridger wilderness areas between 1989 and 1999) to determine the average number of days a 1.0 dv “just noticeable change” would be reached annually in each sensitive area. Although the use of observed hourly optical extinction and relative humidity values is appropriate in this NEPA analysis (where the potential visibility impacts are predicted to occur under the Alternatives based on the reasonably foreseeable background conditions), EPA’s Regional Haze Regulations are based on optical conditions reconstructed from $PM_{2.5}$ and PM_{10} data collected every third day under the IMPROVE program.

7.0 Modeling Assumptions

When reviewing the predicted near- and far-field air quality impacts, it is important to understand that assumptions were made regarding development, emissions, meteorology, atmospheric transport and chemistry, and atmospheric deposition. For example, there is uncertainty regarding ultimate development (i.e., number of wells, equipment to be used, specific locations of wells, etc.).

The following assumptions were used in the analysis:

- Total predicted short-term air pollutant impact concentrations were assumed to be the sum of the assumed background concentration, plus the predicted maximum cumulative modeled concentrations, which may occur under different meteorological conditions.
- Assumed background air pollution concentrations were assumed to occur throughout the 20-year life of project (LOP) at all locations in the region, even though monitoring is primarily conducted in urban or industrial areas, rather than rural areas. The uniform background PM_{10} levels for each state are assumed to be representative of the background conditions for the entire modeled area of the PRB, based on monitoring data gathered throughout northeastern Wyoming and southeastern Montana.
- The maximum predicted air quality impacts occur only in the vicinity of the anticipated emission sources. Actual impacts would likely be less at distances beyond the predicted points of maximum impact.
- All emission sources were assumed to operate at their reasonably foreseeable maximum emission rates simultaneously throughout the LOP. Given the number of sources included in this analysis, the probability of such a scenario actually occurring over an entire year is small.
- In developing the emissions inventory and model, there is uncertainty regarding ultimate development (i.e., number of wells, equipment to be used, specific locations, etc.) Most (90 per cent) proposed CBM wells and 30 per cent of conventional wells were assumed to be fully operational and remain operating (no shut ins) throughout the LOP.
- The total proposed booster (field) and pipeline (sales) compression engines were assumed to operate at their rated capacities continuously throughout the LOP (no phased increases or

reductions). In reality, compression equipment would be added or removed incrementally as required by the well field operation, compressor engines would operate below full horsepower ratings, and it is unlikely all compressor stations would operate at maximum levels simultaneously.

- The HAP analyses assumed a six-unit, 1,650 hp each, reciprocating compressor engine station would operate at full load and at maximum emission levels continuously throughout the LOP.

- The emissions inventory and model use peak years of construction and peak years of operations, which would not occur throughout the entire development region at the same time. However, these conditions may occur in some areas.

- The emissions inventory and model assumed that a reasonably foreseeable emission rate for compressor engines of 1.5 g/hp-hr of nitrogen oxides (NO_x)is achievable in Montana. Since BACT is decided on a case-by-case basis, actual emission rates could be decided to be less or more than this level by the Departments of Environmental Quality in Montana or Wyoming, and on Indian lands by EPA, for field and sales compressor engines. Reasonable NO_x emission rates may range from 0.7 to 2 g/hp-hr.

- There are no applicable local, state, tribal or federal acid deposition standards. In the absence of applicable standards, the acid deposition analysis assumed that a "limit of acceptable change" is: a 10 per cent change in acid neutralizing capacity (ANC) for lakes with a background ANC greater than 25 μeq/l; or a 1 μeq/l change in ANC for lakes with a background ANC less than 25 μeq/l, and would be a reasonably foreseeable significant adverse impact. Further, the atmospheric deposition impact analysis assumed no other ecosystem components would affect lake chemistry for a full year (assuming no chemical buffering due to interaction with vegetation or soil materials).

- The visibility impact analysis assumed that a 1.0 dv "just noticeable change" would be a reasonably foreseeable significant adverse impact, although there are no applicable local, state, tribal or federal regulatory visibility standards. However, some FLMs are using 0.5 dv as a screening threshold for significance.

- Mitigation measures are included in the emissions inventory and model that may not be achievable in all circumstances. However, actual mitigation decided by the developers and local and state authorities may be greater or less than those assumed in the analysis. For example, maintaining a construction road speed limit of 15 mph may be reasonable in a construction zone but difficult to enforce elsewhere. Full (100%) mitigation of fugitive dust from disturbed lands may not be achievable. Further, 50% reduction in fugitive emissions is assumed based on construction road wetting on the unimproved access road to the pad and at the pad, but this level of effectiveness is characterized as the maximum possible. In the air quality modeling, no specific road wetting or other emissions controls were assumed to be used during the operations phase of the development (e.g., for maintenance vehicle traffic). However, during the review of proposed projects (Applications for Permit to Drill) the BLM would require specific mitigation measures in certain areas during the operational phase of development.

- Induced or secondary growth related to increases in vehicle miles traveled (VMT) (believed to be on the order of 10 per cent overall) is not included in the emissions inventory and model. Not all fugitive dust emissions (including county and other collector roads) have been included in the emissions inventory and model.

- Fugitive dust emissions from roads are treated as area sources rather than line sources in the model, which may thereby reduce or increase the predicted ambient concentrations at maximum concentration receptor points near the source, depending on the inputs to the model (meteorology, terrain, etc.) By not placing modeled receptors close to emission sources (e.g. wells and roads), the model may not capture higher ambient concentrations near these sources. A more refined, regulatory model may yield higher concentrations at locations near fugitive dust sources.

- For comparisons to the PSD Class I and II increments, the emissions inventory and model included only CBM and RFFA sources. Other existing increment consuming sources such as Campbell County, Wyoming coal mines were not included in this comparison, as the air quality analysis does not represent a regulatory PSD increment consumption analysis. A regulatory PSD increment consumption analysis needs to identify and consider all PSD increment consuming sources to determine the level of PSD Class II increment consumption. Monitoring data in Wyoming has indicated an upward trend in PM concentrations in Campbell County since 1999,

which coincides with CBM development but is also exacerbated by prolonged drought in the region.

It is important to note that before actual development could occur, the applicable air quality regulatory agencies (including the state, tribe or EPA) would review specific air pollutant emissions pre-construction permit applications that examine potential project-specific air quality impacts for some source categories. As part of these permit reviews (depending on source size), the air quality regulatory agencies could require additional air quality impact analyses or mitigation measures. Thus, before development occurs, additional site-specific air quality analyses would be performed to ensure protection of air quality.

8.0 Modeling Results

The following Tables present the detailed atmospheric dispersion modeling results which are summarized in **Chapter 4, Environmental Consequences (Air Quality)**.

TABLE AQ-3
PREDICTED HAZARDOUS AIR POLLUTANT IMPACTS AND SIGNIFICANCE THRESHOLDS (IN ($\mu G/M^3$)

Pollutant	Averaging Time	Direct Modeled Impact	Range of State Acceptable Ambient Concentration Levels
formaldehyde	8-hours	**11.9**	**4.5** (FL07) - 71 (NV01)
n-hexane	8-hours	0.6	1,800 (FL07) - 36,000 (CT01)
benzene	8-hours	0.7	30 (FL04) - 714 (NV01)
toluene	8-hours	4.6	1,870 (IN03) - 8,930 (NV01)
ethyl benzene	8-hours	< 0.1	4,340 (ND01) - 43,500 (VT01)
xylene	8-hours	0.2	2,170 (IN01) - 10,400 (NV01)

Source: Argonne (2002)

Agencies: CT01 - Connecticut Department of Environmental Protection; Air Compliance Unit
FL04 - Broward County Department of Natural Resource Protection (Florida)
FL07 - Pinellas County Air Pollution Control Board (Florida)
IN01 - Indiana Department of Environmental Management
IN03 - Indianapolis Air Pollution Control Division (Indiana)
ND01 - North Dakota Dept. of Health; Division of Environmental Engineering
NV01 - Nevada Division of Environmental Protection; Air Quality Control
VT01 - Vermont Dept. of Environmental Conservation; Air Pollution Control Division

TABLE AQ-4
ALTERNATIVE A—PREDICTED CRITERIA POLLUTANT IMPACTS AND APPLICABLE SIGNIFICANCE THRESHOLDS (IN (μG/M^3)

Pollutant	Avg Time [a]	Location	PSD Increment	Alt A Project	Non-Project	Cum	Background	Total	NAAQS	MAAQS
carbon monoxide	1-hour	near-field	- - -	49	540	540	15,000	15,540	40,000	26,000
		far-field [1]	- - -	1	100	100	15,000	15,100	40,000	26,000
	8-hours	near-field	- - -	30	311	314	6,600	6,914	10,000	10,000
		far-field [1]	- - -	<1	52	52	6,600	6,652	10,000	10,000
nitrogen dioxide	1-hour	near-field	- - -	21	181	187	117	304	- - -	566
		far-field [1]	- - -	2.0	36	36	117	153	- - -	566
	Annual	near-field	25	1.9	4.8	6.0	11	17	100	100
		far-field [3]	25	1.2	1.1	2.0	11	13	100	100
		far-field [2]	2.5	0.2	0.5	0.7	11	12	100	100
$PM_{2.5}$	24-hours	near-field	- - -	1.0	44.1	44.4	20	64	65	- - -
		far-field [4]	- - -	0.1	12.7	12.7	20	33	65	- - -
	Annual	near-field	- - -	0.3	5.6	5.8	8	14	15	- - -
		far-field [4]	- - -	0.0	1.2	1.2	8	9	15	- - -
PM_{10}	24-hours	near-field	**30** [b]	1.8	**104** [b]	**105** [b]	105	**210** [c]	**150** [c]	**150** [c]
		far-field [4]	30	0.1	29.7	29.7	105	135	150	150
		far-field [2]	**8** [b]	0.5	**8.4** [b]	**8.7** [b]	105	114	150	150
		far-field [5]	8	0.2	7.2	7.4	105	112	150	150
	Annual	near-field	17	0.5	13.1	13.4	30	43	50	50
		far-field [4]	17	0.0	2.7	2.7	30	33	50	50
sulfur dioxide	1-hour	near-field	- - -	1.9	27.4	28.0	666	694	- - -	1,300
		far-field [3]	- - -	1.2	29.6	29.6	666	696	- - -	1,300
	3-hours	near-field	512	1.5	22.6	23.3	291	314	1,300	- - -
		far-field [3]	512	1.0	17.1	17.1	291	308	1,300	- - -
	24-hours	near-field	91	0.9	9.8	10.2	73	83	365	260
		far-field [3]	91	0.6	5.3	5.3	73	78	365	260
	Annual	near-field	20	0.3	1.0	1.1	16	17	80	60
		far-field [3]	20	0.2	0.4	0.4	16	16	80	60

Source: Argonne (2002)

Notes:

[a] Annual impacts are the first maximum value; short-term impacts are the second maximum value. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

[b] It is possible that Non-Project and **Cum** emission sources could exceed the PSD Class I increment on the Northern Cheyenne Indian Reservation, as well as the PSD Class II increment near the maximum assumed development; a regulatory "PSD Increment Consumption Analysis" should be conducted during permitting by the appropriate air quality regulatory agency.

[c] Two receptor locations just south of the Spring Creek Coal Mine when combined with an assumed background concentration of 105 µg/m^2 were predicted to exceed the National and Montana ambient air quality standards due to Non-Project and **Cum** emission sources.

Alt A Project - Direct modeled Alternative A project sources impacts.
Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alt A**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS Alternative 1 sources. Potential impacts from Wyoming Alternatives 2A, 2B and 3 would be less.
Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact location, they may not be a simple sum of the maximum direct **Alt A** Project and Non-Project impacts, which can occur at different locations.
Total - The sum of the cumulative modeled impact and the assumed background concentration.
NAAQS - Applicable National Ambient Air Quality Standard.
MAAQS - Applicable Montana Ambient Air Quality Standard.

Locations:
1 – Absaroka-Beartooth Wilderness Area
2 – Northern Cheyenne Indian Reservation
3 – Crow Indian Reservation
4 – Fort Belknap Indian Reservation
5 – Washakie Wilderness Area

TABLE AQ-5
ALTERNATIVE A - PREDICTED ATMOSPHERIC DEPOSITION IMPACTS AND APPLICABLE SIGNIFICANCE THRESHOLDS

			Total Sulfur Deposition (kg/ha-yr)				Total Nitrogen Deposition (kg/ha-yr)				Acid Neutralizing Capacity (per cent)				
Location	**PSD Class**	**Lake**	**Alt A Project**	**Non-Project**	**Cum**	**Thld**	**Alt A Project**	**Non-Project**	**Cum**	**Thld**	**Bkgd (µeq/l)**	**Alt A Project**	**Non-Project**	**Cum**	**Thld**
Bridger WA	I	Black Joe	<0.01	0.01	0.01	5	<0.01	0.03	0.03	3	69.0	0.1	2.2	2.3	10
		Deep	<0.01	0.01	0.01	5	<0.01	0.03	0.03	3	61.0	0.1	2.5	2.6	10
		Hobbs	<0.01	0.01	0.01	5	<0.01	0.02	0.02	3	68.0	<0.1	1.2	1.3	10
		Upper Frozen	<0.01	0.01	0.01	5	<0.01	0.03	0.03	3	5.8	<0.1 [a]	**1.6** [a]	**1.6** [a]	**1** [a]
Fitzpatrick WA	I	Ross	<0.01	0.01	0.01	5	<0.01	0.02	0.02	3	61.4	0.1	1.7	1.7	10
Absaroka-Beartooth WA	II	Stepping Stone	<0.01	0.02	0.02	5	<0.01	0.02	0.03	3	27.0	0.1	2.0	2.1	10
		Twin Island	<0.01	0.01	0.02	5	<0.01	0.02	0.03	3	36.0	0.1	1.4	1.5	10
Cloud Peak WA	II	Emerald	<0.01	0.03	0.03	5	<0.01	0.07	0.08	3	53.3	0.2	4.4	4.6	10
		Florence	<0.01	0.03	0.03	5	<0.01	0.08	0.08	3	32.7	0.3	8.1	8.4	10
Popo Agie WA	II	Lower Saddlebag	<0.01	0.01	0.01	5	<0.01	0.03	0.03	3	55.5	0.1	3.2	3.2	10

Source: Argonne (2002)

Notes: **Alt A** Project - Direct modeled Alternative A impacts.

Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alt A**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS Alternative 1 sources. Potential impacts from Wyoming Alternatives 2A, 2B and 3 would be less.

Cum – Cumulative modeled impacts. Since these values represent the maximum cumulative impact at a specific location, they are the sum of the maximum direct **Alt A Project** and **Non-Project** impacts. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

Thld – Impact threshold. Total sulfur and nitrogen thresholds from Fox, et al. (1989); acid neutralizing capacity thresholds from FS (2000).

WA – Wilderness Area.

a - Since the background acid neutralizing capacity at Upper Frozen Lake is less than 25 µeq/l, the applicable significance threshold is less than a 1 µeq/l change. This threshold is exceeded by Non-Project and **Cum** emission sources. However, the background concentration is based on only six samples taken on four days between 1997 and 2001.

TABLE AQ-6
ALTERNATIVE A—DAILY FLAG REFINED METHOD—VISIBILITY IMPACT ANALYSIS
(NUMBER OF DAYS Δ1.0 DV PER YEAR)

Sensitive Location	PSD Classification	Alt A Project	Non-Project	Cum
Badlands WA	mandatory federal Class I	0	17 to 25	18 to 25
Bridger WA	mandatory federal Class I	0	8 to 10	8 to 10
Fitzpatrick WA	mandatory federal Class I	0	7 to 9	8 to 10
Gates of the Mountains WA	mandatory federal Class I	0	3 to 4	3 to 4
Grand Teton NP	mandatory federal Class I	0	4 to 6	4 to 6
North Absaroka WA	mandatory federal Class I	0	10 to 12	11 to 12
Red Rock Lakes WA	mandatory federal Class I	0	0 to 1	0 to 1
Scapegoat WA	mandatory federal Class I	0	2 to 2	2 to 3
Teton WA	mandatory federal Class I	0	7 to 9	7 to 10
Theodore Roosevelt NP (North Unit)	mandatory federal Class I	0	1 to 2	1 to 2
Theodore Roosevelt NP (South Unit)	mandatory federal Class I	0	2 to 4	2 to 4
U.L. Bend WA	mandatory federal Class I	0	5 to 5	5 to 6
Washakie WA	mandatory federal Class I	0	11 to 14	12 to 15
Wind Cave NP	mandatory federal Class I	0	21 to 27	22 to 28
Yellowstone NP	mandatory federal Class I	0	9 to 11	9 to 11
Fort Peck IR	Tribal designated Class I	0	1 to 2	2 to 2
Northern Cheyenne IR	Tribal designated Class I	0	30 to 38	33 to 42
Absaroka-Beartooth WA	federal Class II	0	28 to 29	28 to 30
Agate Fossil Beds NM	federal Class II	0	10 to 15	10 to 15
Bighorn Canyon NRA	federal Class II	0	19 to 21	19 to 23
Black Elk WA	federal Class II	0	20 to 26	20 to 26
Cloud Peak WA	federal Class II	0	21 to 28	23 to 30
Crow IR	federal Class II	2	56 to 61	65 to 69
Devils Tower NM	federal Class II	0	24 to 38	26 to 39
Fort Belknap IR	federal Class II	0	60 to 61	61 to 61
Fort Laramie NHS	federal Class II	0	13 to 17	13 to 17

TABLE AQ-6
ALTERNATIVE A—DAILY FLAG REFINED METHOD—VISIBILITY IMPACT ANALYSIS
(NUMBER OF DAYS Δ1.0 DV PER YEAR)

Sensitive Location	PSD Classification	Alt A Project	Non-Project	Cum
Jewel Cave NM	federal Class II	0	24 to 31	24 to 32
Mount Rushmore NMem	federal Class II	0	17 to 22	17 to 22
Popo Agie WA	federal Class II	0	8 to 10	8 to 10
Soldier Creek WA	federal Class II	0	13 to 18	13 to 18

Source: Argonne (2002)

Notes: **Alt A** Project - Direct modeled Alternative 1 impacts.

Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alt A**, including the Wyoming “Powder River Basin Oil and Gas Project” DEIS sources. The range of values corresponds to including Wyoming Alternative 3 (low) to Wyoming Alternative 1 (high).

Cum - Cumulative modeled impacts. Since these values represent the maximum visibility impact anywhere within the sensitive location, they may not be a simple sum of the maximum direct **Alt A** Project and Non-Project impacts, which can occur at different locations. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

Locations:

IR - Indian Reservation. **NHS** - National Historic Site. **NM** - National Monument

NMem - National Memorial. **NP** - National Park. **NRA** - National Recreation Area

WA - Wilderness Area.

TABLE AQ-7
ALTERNATIVES B/C/E - PREDICTED CRITERIA POLLUTANT IMPACTS AND APPLICABLE SIGNIFICANCE THRESHOLDS (IN (µG/M³)

Pollutant	Avg Time [a]	Location	PSD Increment	Alts B/C/E Project	Alts B/C/E Project + RFFA	Non-Project	Cum	Back-ground	Total	NAAQS	MAAQS
carbon monoxide	1-hour	near-field	- - -	109	112.6	540.0	548.2	15,000	15,548	40,000	26,000
		far-field [1]	- - -	6	7.3	100.0	100.0	15,000	15,100	40,000	26,000
	8-hours	near-field	- - -	74	77.2	311.3	337.2	6,600	6,937	10,000	10,000
		far-field [2]	- - -	56	57.8	28.9	78.0	6,600	6,677	10,000	10,000
nitrogen dioxide	1-hour	near-field	- - -	100	102.3	181.0	207.3	117	324.3	- - -	566
		far-field [3]	- - -	58	60.1	27.5	73.3	117	190.3	- - -	566
	Annual	near-field	25	9.1	9.4	4.8	10.7	11	21.7	100	100
		far-field [3]	25	3.9	4.7	1.1	5.4	11	16.4	100	100
		far-field [2]	**2.5** [c]	1.9	**3.7** [c]	0.5	**4.2** [c]	11	15.2	100	100
$PM_{2.5}$	24-hours	near-field	- - -	6.2	6.9	44.1	45.9	20	**65.9** [b]	**65** [b]	- - -
		far-field [3]	- - -	4.2	5.1	10.6	14.7	20	34.7	65	- - -
	Annual	near-field	- - -	1.4	1.5	5.6	6.3	8	14.3	15	- - -
		far-field [3]	- - -	0.7	0.8	0.5	1.2	8	9.2	15	- - -
PM_{10}	24-hours	near-field	**30** [c]	12.1	13.1	**103.8** [c]	**107.1** [c]	105	**212.1** [d]	**150** [d]	**150** [d]
		far-field [4]	30	0.3	0.4	29.7	29.7	105	134.7	150	150
		far-field [2]	**8** [c]	4.2	5.9	**8.4** [c]	**12.8** [c]	105	117.8	150	150
		far-field [5]	**8** [c]	1.4	2.0	7.2	**9.2** [c]	105	114.2	150	150
	Annual	near-field	17	3.6	3.7	13.1	14.3	30	44.3	50	50
		far-field [4]	17	<0.1	<0.1	2.7	2.7	30	32.7	50	50
sulfur dioxide	1-hour	near-field	- - -	4.6	4.6	27.4	28.2	666	694.2	- - -	1,300
		far-field [3]	- - -	2.2	2.2	29.6	29.6	666	695.6	- - -	1,300
	3-hours	near-field	512	3.5	3.5	22.6	23.6	291	314.6	1,300	- - -
		far-field [3]	512	1.7	1.8	17.1	17.1	291	308.1	1,300	- - -
	24-hours	near-field	91	2.1	2.1	9.8	10.5	73	83.5	365	260
		far-field [3]	91	1.0	1.1	5.3	5.3	73	78.3	365	260
	Annual	near-field	20	0.7	0.7	1.0	1.2	16	17.2	80	60
		far-field [3]	20	0.3	0.3	0.4	0.4	16	16.4	80	60

Source: Argonne (2002)

Notes:

[a] Annual impacts are the first maximum value; short-term impacts are the second maximum value. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.
[b] Two receptor locations just south of the Spring Creek Coal Mine when combined with an assumed background concentration of 20 $\mu g/m^2$ were predicted to exceed the National ambient air quality standards due to **Cum** emission sources.
[c] It is possible that **Alts B/C/E Project + RFFA**, Non-Project and/or **Cum** emission sources could exceed the PSD Class I increment on the Northern Cheyenne Indian Reservation and the Washakie Wilderness Area, as well as the PSD Class II increment near the maximum assumed development; a regulatory "PSD Increment Consumption Analysis" should be conducted during permitting by the appropriate air quality regulatory agency.
[d] Two receptor locations just south of the Spring Creek Coal Mine when combined with an assumed background concentration of 105 $\mu g/m^2$ were predicted to exceed the National and Montana ambient air quality standards due to Non-Project and **Cum** emission sources.

Alts B/C/E Project - Direct modeled Alternatives' B/C/E impacts.
Alts B/C/E Project + RFFA - Direct modeled Alternatives' B/C/E impacts combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest.
Non-Project – Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alts B/C/E**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS Alternative 1 sources. Potential impacts from Wyoming Alternatives 2A, 2B and 3 would be less.
Cum – Cumulative modeled impacts. Since these values represent the maximum cumulative impact location, they may not be a simple sum of the maximum direct **Alts B/C/E** Project and Non-Project impacts, which can occur at different locations.
Total - The sum of the cumulative modeled impact and the assumed background concentration.
NAAQS – Applicable National Ambient Air Quality Standard.
MAAQS – Applicable Montana Ambient Air Quality Standard.

Locations:
1 – Absaroka-Beartooth Wilderness Area
2 – Northern Cheyenne Indian Reservation
3 – Crow Indian Reservation
4 – Fort Belknap Indian Reservation
5 – Washakie Wilderness Area

TABLE AQ-8
ALTERNATIVES B/C/E - PREDICTED ATMOSPHERIC DEPOSITION IMPACTS AND APPLICABLE SIGNIFICANCE THRESHOLDS

			Total Sulfur Deposition (kg/ha-yr)					Total Nitrogen Deposition (kg/ha-yr)					Acid Neutralizing Capacity (per cent)					
Location	PSD Class	Lake	Alts B/C/E Project	Alts B/C/E Project + RFFA	Non-Project	Cum	Thld	Alts B/C/E Project	Alts B/C/E Project + RFFA	Non-Project	Cum	Thld	Bkgd (μeq/l)	Alts B/C/E Project	Alts B/C/E Project + RFFA	Non-Project	Cum	Thld
Bridger WA	I	Black Joe	<0.01	<0.01	0.01	0.01	5	<0.01	0.01	0.03	0.03	3	69.0	0.3	0.4	2.2	2.6	10
		Deep	<0.01	<0.01	0.01	0.01	5	<0.01	0.01	0.03	0.03	3	61.0	0.3	0.4	2.5	2.9	10
		Hobbs	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.02	0.02	3	68.0	0.2	0.3	1.2	1.5	10
		Upper Frozen	<0.01	<0.01	0.01	0.01	5	<0.01	0.01	0.03	0.03	3	5.8	0.2 [a]	0.25 [a]	**1.6 [a]**	**1.8 [a]**	**1 [a]**
Fitzpatrick WA	I	Ross	<0.01	<0.01	0.01	0.01	5	<0.01	0.01	0.02	0.02	3	61.4	0.3	0.4	1.7	2.1	10
Absaroka-Beartooth WA	II	Stepping Stone	<0.01	<0.01	0.02	0.02	5	0.01	0.01	0.02	0.03	3	27.0	0.4	0.6	2.0	2.5	10
		Twin Island	<0.01	<0.01	0.01	0.02	5	0.01	0.01	0.02	0.03	3	36.0	0.3	0.4	1.4	1.8	10
Cloud Peak WA	II	Emerald	<0.01	<0.01	0.03	0.03	5	0.02	0.03	0.07	0.10	3	53.3	1.1	1.4	4.4	5.9	10
		Florence	<0.01	<0.01	0.03	0.03	5	0.02	0.03	0.08	0.11	3	32.7	1.7	2.3	8.1	**10.4[b]**	**10[b]**
Popo Agie WA	II	Lower Saddlebag	<0.01	<0.01	0.01	0.01	5	<0.01	0.01	0.03	0.04	3	55.5	0.3	0.5	3.2	3.6	10

Source: Argonne (2002)

Notes: **Alts B/C/E** Project - Direct modeled Alternatives' B/C/E impacts.

Alts B/C/E Project + RFFA - Direct modeled Alternatives' B/C/E impacts combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest

Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alts B/C/E**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS Alternative 1 sources. Potential impacts from Wyoming Alternatives 2A, 2B and 3 would be less.

Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact at a specific location, they are the sum of the maximum direct **Alts B/C/E** Project and Non-Project impacts. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

Thld - Impact threshold. Total sulfur and nitrogen thresholds from Fox, et al. (1989); acid neutralizing capacity thresholds from FS (2000).

WA - Wilderness Area.

a - Since the background acid neutralizing capacity at Upper Frozen Lake is less than 25 μeq/l, the applicable significance threshold is less than a 1 μeq/l change. This threshold is exceeded by Non-Project and **Cum** emission sources. However, the background concentration is based on only six samples taken on four days between 1997 and 2001.

b – The potential cumulative impact of 10.4 μeq/l change would exceed the threshold level of 10 μeq/l for Florence Lake.

TABLE AQ-9
ALTERNATIVES B/C/E - DAILY FLAG REFINED METHOD - VISIBILITY IMPACT ANALYSIS
(NUMBER OF DAYS Δ1.0 DV PER YEAR)

Sensitive Location	PSD Classification	Alts B/C/E Project	Alts B/C/E Project + RFFA	Non-Project	Cum
Badlands WA	mandatory federal Class I	0	0	17 to 25	21 to 28
Bridger WA	mandatory federal Class I	2	3	8 to 10	10 to 12
Fitzpatrick WA	mandatory federal Class I	2	3	7 to 9	10 to 12
Gates of the Mountains WA	mandatory federal Class I	0	0	3 to 4	4 to 4
Grand Teton NP	mandatory federal Class I	0	0	4 to 6	6 to 8
North Absaroka WA	mandatory federal Class I	2	4	10 to 12	13 to 15
Red Rock Lakes WA	mandatory federal Class I	0	0	0 to 1	2 to 3
Scapegoat WA	mandatory federal Class I	0	0	2 to 2	3 to 3
Teton WA	mandatory federal Class I	1	3	7 to 9	10 to 11
Theodore Roosevelt NP (North Unit)	mandatory federal Class I	0	0	1 to 2	2 to 3
Theodore Roosevelt NP (South Unit)	mandatory federal Class I	0	1	2 to 4	4 to 7
U.L. Bend WA	mandatory federal Class I	1	1	5 to 5	6 to 8
Washakie WA	mandatory federal Class I	3	5	11 to 14	16 to 18
Wind Cave NP	mandatory federal Class I	0	0	21 to 27	25 to 32
Yellowstone NP	mandatory federal Class I	1	3	9 to 11	12 to 13
Fort Peck IR	Tribal designated Class I	0	1	1 to 2	4 to 5
Northern Cheyenne IR	Tribal designated Class I	33	60	30 to 38	87 to 92
Absaroka-Beartooth WA	federal Class II	2	4	28 to 29	32 to 33
Agate Fossil Beds NM	federal Class II	0	0	10 to 15	14 to 19
Bighorn Canyon NRA	federal Class II	9	17	19 to 21	32 to 34
Black Elk WA	federal Class II	0	1	20 to 26	24 to 31
Cloud Peak WA	federal Class II	6	10	21 to 28	35 to 39
Crow IR	federal Class II	61	75	56 to 61	113 to 116

TABLE AQ-9
ALTERNATIVES B/C/E - DAILY FLAG REFINED METHOD - VISIBILITY IMPACT ANALYSIS (NUMBER OF DAYS Δ1.0 DV PER YEAR)

Sensitive Location	PSD Classification	Alts B/C/E Project	Alts B/C/E Project + RFFA	Non-Project	Cum
Devils Tower NM	federal Class II	1	3	24 to 38	34 to 47
Fort Belknap IR	federal Class II	1	1	60 to 61	61 to 62
Fort Laramie NHS	federal Class II	0	1	13 to 17	16 to 20
Jewel Cave NM	federal Class II	0	0	24 to 31	28 to 36
Mount Rushmore NMem	federal Class II	0	0	17 to 22	20 to 26
Popo Agie WA	federal Class II	2	3	8 to 10	11 to 13
Soldier Creek WA	federal Class II	0	0	13 to 18	16 to 21

Source: Argonne (2002)

Notes: **Alts B/C/E Project** - Direct modeled Alternatives' B/C/E impacts.

Alts B/C/E Project + RFFA - Direct modeled Alternatives' B/C/E impacts combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest.

Non-Project - Direct modelednon-project source impacts. The impact from all air pollutant emission sources not included in **Alts B/C/E**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS sources. The range of values corresponds to including Wyoming Alternative 3 (low) to Wyoming Alternative 1 (high).**Cum** - Cumulative modeled impacts. Since these values represent the maximum visibility impact anywhere within the sensitive location, they may not be a simple sum of the maximum direct **Alts B/C/E** Project and Non-Project impacts, which can occur at different locations. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

Locations:

IR - Indian Reservation. **NHS** - National Historic Site. **NM** - National Monument

NMem - National Memorial. **NP** - National Park. **NRA** - National Recreation Area

WA - Wilderness Area.

TABLE AQ-10
ALTERNATIVE D - PREDICTED CRITERIA POLLUTANT IMPACTS AND APPLICABLE SIGNIFICANCE THRESHOLDS (IN (μG/M^3)

Pollutant	Avg Time [a]	Location	PSD Increment	Alt D Project	Alt D Project + RFFA	Non-Project	Cum	Back-ground	Total	NAAQS	MAAQS
carbon monoxide	1-hour	near-field	- - -	48	47.7	540	540.8	15,000	15,541	40,000	26,000
		far-field [1]	- - -	2	2.2	100	100.0	15,000	15,100	40,000	26,000
	8-hours	near-field	- - -	29	29.6	311.3	319.8	6,600	6,920	10,000	10,000
		far-field [1]	- - -	1	1.8	52	51.8	6,600	6,652	10,000	10,000
nitrogen dioxide	1-hour	near-field	- - -	50	59.6	181	195.1	117	312.1	- - -	566
		far-field [3]	- - -	33	32.7	27.5	43.9	117	160.1	- - -	566
	Annual	near-field	25	6.4	6.5	4.8	7.8	11	18.814.	100	100
		far-field [3]	25	2.4	2.8	1.1	3.5	11	5	100	100
		far-field [2]	2.5	1.1	2.0	0.5	**2.5**[e]	11	13.5	100	100
$PM_{2.5}$	24-hours	near-field	- - -	4.3	4.7	44.1	45.3	20	**65.3** [b]	**65** [b]	- - -
		far-field [3]	- - -	2.6	2.9	10.6	12.8	20	32.8	65	- - -
	Annual	near-field	- - -	1.2	1.2	5.6	6.0	8	14.0	15	- - -
		far-field [4]	- - -	<0.1	<0.1	1.2	1.2	8	9.2	15	- - -
PM_{10}	24-hours	near-field	**30** [c]	10.8	11.5	**103.8** [c]	**106.5** [c]	105	**211.5** [d]	**150** [d]	**150** [d]
		far-field [4]	30	0.1	0.2	29.7	29.7	105	134.7	150	150
		far-field [2]	**8** [c]	3.3	4.4	**8.4** [c]	**11.1** [c]	105	116.1	150	150
		far-field [5]	**8** [c]	0.6	0.9	7.2	**8.1** [c]	105	113.1	150	150
	Annual	near-field	17	3.3	3.4	13.1	14.1	30	44.1	50	50
		far-field [4]	17	<0.1	<0.1	2.7	2.7	30	32.7	50	50
sulfur dioxide	1-hour	near-field	- - -	4.5	4.5	27.4	28.2	666	694.2	- - -	1,300
		far-field [3]	- - -	2.2	2.2	29.6	29.6	666	695.6	- - -	1,300
	3-hours	near-field	512	3.5	3.5	22.6	23.6	291	314.6	1,300	- - -
		far-field [3]	512	1.7	1.8	17.1	17.1	291	308.1	1,300	- - -
	24-hours	near-field	91	2.1	2.1	9.8	10.5	73	83.5	365	260
		far-field [3]	91	1.0	1.1	5.3	5.3	73	78.3	365	260
	Annual	near-field	20	0.7	0.7	1.0	1.2	16	17.1	80	60
		far-field [3]	20	0.3	0.3	0.4	0.4	16	16.4	80	60

Source: Argonne (2002)

Notes: [a] Annual impacts are the first maximum value; short-term impacts are the second maximum value. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

[b] Two receptor locations just south of the Spring Creek Coal Mine when combined with an assumed background concentration of 20 $\mu g/m^2$ were predicted to exceed the National ambient air quality standards due to **Cum** emission sources.

[c] It is possible that Non-Project and/or **Cum** emission sources could exceed the PSD Class I increment on the Northern Cheyenne Indian Reservation and Washakie Wilderness Area, as well as the PSD Class II increment near the maximum assumed development; a regulatory "PSD Increment Consumption Analysis" should be conducted during permitting by the appropriate air quality regulatory agency.

[d] Two receptor locations just south of the Spring Creek Coal Mine when combined with an assumed background concentration of 105 $\mu g/m^2$ were predicted to exceed the National and Montana ambient air quality standards due to **Cum** emission sources.

[e] Actual model results equal to 2.45 $\mu g/m^3$. See Argonne (2002) Appendix C, Table C.1.2.3.

Alt D Project - Direct modeled Alternative D impacts.

Alts D Project + RFFA - Direct modeled Alternatives' D impacts combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest.

Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alt D**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS Alternative 1 sources. Potential impacts from Wyoming Alternatives 2A, 2B and 3 would be less.

Cum – Cumulative modeled impacts. Since these values represent the maximum cumulative impact location, they may not be a simple sum of the maximum direct **Alt D** Project and Non-Project impacts, which can occur at different locations.

Total - The sum of the cumulative modeled impact and the assumed background concentration.

NAAAQS - Applicable National Ambient Air Quality Standard.

MAAQS - Applicable Montana Ambient Air Quality Standard.

Locations:

1 – Absaroka-Beartooth Wilderness Area

2 – Northern Cheyenne Indian Reservation

3 – Crow Indian Reservation

4 – Fort Belknap Indian Reservation

5 – Washakie Wilderness Area

TABLE AQ-11
ALTERNATIVE D - PREDICTED ATMOSPHERIC DEPOSITION IMPACTS AND APPLICABLE SIGNIFICANCE THRESHOLDS

			Total Sulfur Deposition (kg/ha-yr)					Total Nitrogen Deposition (kg/ha-yr)					Acid Neutralizing Capacity (per cent)					
Location	PSD Class	Lake	Alt D Project	Alt D Project + RFFA	Non-Project	Cum	Thld	Alt D Project	Alt D Project + RFFA	Non-Project	Cum	Thld	Bkgd (µeq/l)	Alt D Project	Alt D Project + RFFA	Non-Project	Cum	Thld
Bridger WA	I	Black Joe	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.03	0.03	3	69.0	0.2	0.2	2.2	2.4	10
		Deep	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.03	0.03	3	61.0	0.2	0.2	2.5	2.7	10
		Hobbs	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.02	0.02	3	68.0	0.1	0.2	1.2	1.4	10
		Upper Frozen	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.03	0.03	3	5.8	0.1 [a]	0.13 [a]	**1.6 [a]**	**1.7 [a]**	**1 [a]**
Fitzpatrick WA	I	Ross	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.02	0.02	3	61.4	0.2	0.2	1.7	1.9	10
Absaroka-Beartooth WA	II	Stepping Stone	<0.01	<0.01	0.02	0.02	5	<0.01	0.01	0.02	0.03	3	27.0	0.3	0.3	2.0	2.3	10
		Twin Island	<0.01	<0.01	0.01	0.02	5	<0.01	0.01	0.02	0.03	3	36.0	0.2	0.2	1.4	1.6	10
Cloud Peak WA	II	Emerald	<0.01	<0.01	0.03	0.03	5	0.01	0.02	0.07	0.09	3	53.3	0.6	0.7	4.4	5.2	10
		Florence	<0.01	<0.01	0.03	0.03	5	0.01	0.02	0.08	0.09	3	32.7	0.9	1.1	8.1	9.2	10
Popo Agie WA	II	Lower Saddlebag	<0.01	<0.01	0.01	0.01	5	<0.01	<0.01	0.03	0.03	3	55.5	0.2	0.2	3.2	3.4	10

Source: Argonne (2002)

Notes: **Alt D** Project - Direct modeled Alternative D impacts.

Alts D Project + RFFA - Direct modeled Alternatives' D impacts combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest.

Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alt D**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS Alternative 1 sources. Potential impacts from Wyoming Alternatives 2A, 2B and 3 would be less.

Cum - Cumulative modeled impacts. Since these values represent the maximum cumulative impact at a specific location, they are the sum of the maximum direct **Alt D** Project and Non-Project impacts. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

Thld - Impact threshold. Total sulfur and nitrogen thresholds from Fox, et al. (1989); acid neutralizing capacity thresholds from FS (2000).

WA - Wilderness Area.

a - Since the background acid neutralizing capacity at Upper Frozen Lake is less than 25 µeq/l, the applicable significance threshold is less than a 1 µeq/l change. This threshold is exceeded by Non-Project and **Cum** emission sources. However, the background concentration is based on only six samples taken on four days between 1997 and 2001.

TABLE AQ-12
ALTERNATIVE D - DAILY FLAG REFINED METHOD - VISIBILITY IMPACT ANALYSIS (NUMBER OF DAYS >1.0 DV PER YEAR)

Sensitive Location	PSD Classification	Alt D Project	Alt D Project + RFFA	Non-Project	Cum
Badlands WA	mandatory federal Class I	0	0	17 to 25	20 to 26
Bridger WA	mandatory federal Class I	0	1	8 to 10	9 to 11
Fitzpatrick WA	mandatory federal Class I	0	0	7 to 9	8 to 10
Gates of the Mountains WA	mandatory federal Class I	0	0	3 to 4	3 to 4
Grand Teton NP	mandatory federal Class I	0	0	4 to 6	5 to 7
North Absaroka WA	mandatory federal Class I	0	1	10 to 12	12 to 14
Red Rock Lakes WA	mandatory federal Class I	0	0	0 to 1	1 to 2
Scapegoat WA	mandatory federal Class I	0	0	2 to 2	2 to 3
Teton WA	mandatory federal Class I	0	0	7 to 9	9 to 10
Theodore Roosevelt NP (North Unit)	mandatory federal Class I	0	0	1 to 2	1 to 2
Theodore Roosevelt NP (South Unit)	mandatory federal Class I	0	0	2 to 4	3 to 5
U.L. Bend WA	mandatory federal Class I	0	0	5 to 5	5 to 6
Washakie WA	mandatory federal Class I	1	1	11 to 14	14 to 16
Wind Cave NP	mandatory federal Class I	0	0	21 to 27	23 to 29
Yellowstone NP	mandatory federal Class I	0	0	9 to 11	11 to 12
Fort Peck IR	Tribal designated Class I	0	0	1 to 2	2 to 3
Northern Cheyenne IR	Tribal designated Class I	17	38	30 to 38	70 to 76
Absaroka-Beartooth WA	federal Class II	0	1	28 to 29	30 to 31
Agate Fossil Beds NM	federal Class II	0	0	10 to 15	12 to 17
Bighorn Canyon NRA	federal Class II	3	7	19 to 21	2 to 28
Black Elk WA	federal Class II	0	0	20 to 26	22 to 28
Cloud Peak WA	federal Class II	1	2	21 to 28	28 to 35
Crow IR	federal Class II	42	56	56 to 61	102 to 105
Devils Tower NM	federal Class II	0	0	24 to 38	29 to 42

TABLE AQ-12
ALTERNATIVE D - DAILY FLAG REFINED METHOD - VISIBILITY IMPACT ANALYSIS (NUMBER OF DAYS >1.0 DV PER YEAR)

Sensitive Location	PSD Classification	Alt D Project	Alt D Project + RFFA	Non-Project	Cum
Fort Belknap IR	federal Class II	0	0	60 to 61	61 to 61
Fort Laramie NHS	federal Class II	0	0	13 to 17	15 to 18
Jewel Cave NM	federal Class II	0	0	24 to 31	26 to 34
Mount Rushmore NMem	federal Class II	0	0	17 to 22	18 to 23
Popo Agie WA	federal Class II	0	1	8 to 10	9 to 11
Soldier Creek WA	federal Class II	0	0	13 to 18	14 to 20

Source: Argonne (2002)

Notes: **Alt D** Project - Direct modeled Alternative D impacts.
Alts D Project + RFFA - Direct modeled Alternatives' D impacts combined with emissions from potential CBM development on the Northern Cheyenne and Crow Indian Reservations and the Ashland District of the Custer National Forest.
Non-Project - Direct modeled non-project source impacts. The impact from all air pollutant emission sources not included in **Alt D**, including the Wyoming "Powder River Basin Oil and Gas Project" DEIS sources. The range of values corresponds to including Wyoming Alternative 3 (low) to Wyoming Alternative 1 (high).
Cum - Cumulative modeled impacts. Since these values represent the maximum visibility impact anywhere within the sensitive location, they may not be a simple sum of the maximum direct **Alt D** Project and Non-Project impacts, which can occur at different locations. There are uncertainties, unquantified at this point, associated with the modeled values. Actual maximum impacts may be larger or smaller than those shown.

Locations:
IR - Indian Reservation. **NHS** - National Historic Site. **NM** - National Monument
NMem - National Memorial. **NP** - National Park. **NRA** - National Recreation Area
WA - Wilderness Area.

9.0 Thresholds For Triggering Mitigation

9.1 Clean Air Act Regulatory Thresholds

For Prevention of Significant Deterioration (PSD) of air quality, modeled and monitored results for $PM_{10}$and NO_2 will be evaluated against the Class I and Class II increments to determine if additional mitigation will be required (see Table AQ-1).

Monitoring data only will be used to determine if the NAAQS PM_{10} and NO_2 standards (see Table AQ-1) have been exceeded. For federal lands with Class I areas, the Clean Air Act sets a 60-year goal of clear vistas. Clear vistas are defined as reduction in visibility not to exceed 1.0 deciview/year for more than 1 day. Where this threshold is exceeded from a single project, this could be the basis for the federal land managers' designation of visibility impairment. Such a designation could necessitate mitigation. Where the threshold is exceeded based on cumulative actions (i.e. RFFA), this also could be the basis for the federal land managers' designation of visibility impairment. In this instance, Congress directed federal land managers to implement mitigation pursuant to the Regional Haze Rule, in a manner that results in a 25% reduction in impairment every 15-year period to meet the 60-year clear vistas goal.

In order to prevent violations of national and local air quality standards, emission controls need to be implemented before standards are violated. For an analytic approach, implementation of control adequate to lead to no predicted cumulative violations are adequate, since all known and anticipated emissions will presumably be modeled within model uncertainties. NO_2 modeling of this well understood gas should be accurate enough to base mitigation decisions.

9.2 "Levels of Concern"

If mitigation measures are not fully implemented until regulatory thresholds are exceeded, then a regulatory process is triggered to resolve the exceedances. Such a process may be lengthy, costly and administratively burdensome. Agencies may wish to avoid such a process by establishing a "level of concern" short of regulatory thresholds, which would trigger implementation of control measures of a type and quantity sufficient to avoid reaching regulatory thresholds.

Where predictive capability is well-developed, as is the case with modeling of NO_2, an LOC might more closely approach the regulatory threshold. However, with a pollutant such as PM_{10}, greater uncertainties exist in the prediction of ambient concentrations due to such factors as differential particle settling. In such a case, an LOC may need to be established at a lower level to achieve the objective of avoiding regulatory exceedances.

9.3 Mitigation Measures

If air quality mitigation applied by all parties in the Powder River Basin are proven to be inadequate, cumulatively, to maintain these Class I and Class II increment limits based on regulatory air quality modeling or monitored conditions, Montana, Wyoming, or the Tribes may impose either a State or Tribal Implementation Plan (SIP or TIP) to assure preservation of the rural air quality. EPA may itself impose a Federal Implementation Plan (FIP) to obtain controls on all regulated pollutant emission sources in order to assure preservation of the rural air quality.

9.4 Mitigation

Tables AQ-13 and AQ-14 include the array of measures available to mitigate potential PM_{10} and NO_x impacts and the effectiveness of each measure.

TABLE AQ-13
FUGITIVE DUST MITIGATION MEASURES (PM10), EFFECTIVENESS AND COST

	Dust Sources					
	Disturbed Areas	**Unpaved Roads**[1]				
Mitigation Options	Establish plant cover for all disturbed lands by certain time (re-vegetation)	Water roads to attain certain percent moisture	Apply soil stabilizer	Set and enforce speed limit	Gravel roads	Pave road
Effectiveness	Level proportional to percentage of land cover	0 – 50% reduction in uncontrolled dust emissions	33 to 100% control efficiency	80% for 15 mph 65% for 20 mph 25% for 30 mph [2]	30% reduction	90% reduction
Estimated Cost	$/acre	$4000/mile	$2,000 to $4,000/mile per year	Unknown	$9,000/mile	$11,000 to $60,000/mile

[1]Improved and County roads
[2]Reductions assume 40 mile per hour base speed.

TABLE AQ-14
NITROGEN OXIDES (NOX) MITIGATION MEASURES EFFICIENCY

	No_x Emissions Sources[1]			
	Field Compressors	**Sales Compressors**	**Temporary Diesel Generators** [2]	**Heavy Equipment**
Mitigation Options/Efficiency	Implement Best Available Control Technology Typically results in a NO_x emission rate of about 1 g/bhp-hr	Implement Best Available Control Technology Typically results in a NO_x emission rate of about 1 g/bhp-hr	Register with State; will regulate as appropriate	Voluntary use of diesel engines

1 Using electric – powered compressor motors in place of the typical natural-gas fired compressor engines could eliminate direct NO_x emissions from compressor station locations.

[2]Wyoming is currently registering these generators to determine if No_x emissions are significant.

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AIR QUALITY MODELING APPENDIX – PART 2

QUANTITATIVE REVIEW OF

AMBIENT AIR QUALITY IMPACTS

Supplement to Statewide Final Oil and Gas Environmental Impact Statement and Amendment of the Powder River and Billings Resource Management Plans

Prepared for

U.S. BUREAU OF LAND MANAGEMENT
Miles City Field Office
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November 2006

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1.0 INTRODUCTION AND BACKGROUND

The Powder River Basin (PRB) of Montana and Wyoming is a major coal resource region in the United States. It has also produced large quantities of natural gas and oil, and has experienced significant development of coal bed natural gas from its coal seams. The region also has a diverse set of environmental values, including proximity to some of the most pristine areas in the United States. Sensitive areas that were evaluated include the identified Class I areas, for air quality regulatory purposes, and other selected Class II sensitive areas, based on previous studies of coal development and coal bed natural gas development in the region.

A Montana Statewide Oil and Gas Environmental Impact Statement (EIS) had been developed in January 2003. This report provides a supplemental analysis of potential impacts related to air quality for Coal Bed Natural Gas Development in the Powder River Basin area. The potential air quality impacts have recently been analyzed as part of two different studies:

- Final Statewide Oil and Gas Environmental Impact Statement and Proposed Amendment of the Powder River and Billings Resource Management Plans, prepared by the Bureau of Land Management Miles City Field Office and the Billings Field Office, and the State of Montana Board of Oil and Gas Conservation and the Montana Department of Environmental Quality (BLM and Montana, 2003); The bulk of the technical review was based on data included in the Technical Support Document (Argonne 2002) that was applied to both the Montana Statewide Oil and Gas EIS, and;
- Task 1A and 3A Reports for the Powder River Basin Coal Review, Cumulative Air Quality Effects, prepared for the BLM Casper Field Office, and the Wyoming State Office (ENSR 2005a, b).

A series of dispersion modeling exercises were conducted for each of the cited studies and analyses. In this report, the studies will be referred to as the Oil and Gas EIS and the Coal Review, respectively. Additional impact analyses have been carried out for the Tongue River Railroad expansion and the Proposed Roundup Power Plant in Musselshell County, Montana. The results of these proposed projects are also incorporated into this report.

This study provides a further evaluation of the air quality-related environmental impacts of continued development of coal bed natural gas resources in the region. The evaluation includes estimating emissions and potential impacts for a base year (2004), and estimating comparative potential impacts for peak development for three separate development scenarios. This report describes the emissions development, summarizes those data, discusses the modeling efforts, and presents results for the base year and alternative development plans.

The purpose of the study was to evaluate the regional changes in air quality potential impacts resulting from three separate development scenarios. The study is not designed to provide specific air permitting data for a specific project. The focus is on potential impacts in the Powder River Basin "region," which is characterized as the near-field grid, and on the sensitive receptor groups surrounding the region. Details of the analysis are provided for all groups, but emphasized for the near-field and for the sensitive areas that have the highest modeled potential impacts from the sources in the region.

Finally, a word should be said regarding dispersion modeling analyses and their use in planning and decision-making. All dispersion models, regardless of their level of complexity, are mathematical approximations (based largely on fluid dynamics) of the behavior of the atmosphere. Therefore, particularly given the uncertain nature of the number and placement of the RFD Alternative sources used in this analysis, the results need to be viewed appropriately as estimates of possible future concentrations and not exact predictions in time and space.

Because of this, dispersion modeling is generally conducted in a somewhat conservative manner, attempting to insure that the final results do not underestimate the actual or future impacts, so that appropriate planning decisions can be made. For example, sources may be assumed to operate for longer times or emit more pollutants than might be reasonable to expect to insure that health-based air standards are protected. On the other hand, analyses are not conducted assuming the worst-case conditions across the board, which could lead to a "false-positive" result. Hence, dispersion modeling analyses are a balancing act, using the best available information and methods (EPA-approved models, emission factors, etc.) when possible, and the best scientific and professional judgment otherwise, trying

to shade the analysis so that the final results do not under-predict the actual concentrations.

Oil and Gas EIS

The Oil and Gas EIS included evaluations of the full range of environmental issues for development in the Montana and Wyoming Project Areas. Figure 1-1 depicts the EIS study area and the receptor grids. For comparison to this study, the EIS included three separate model runs to address potential impacts on air quality for several development alternatives that included no action, a preferred development alternative, and three other alternatives that addressed varying development limitations or emphases. The study addressed potential impacts from project sources and from non-project sources in a five-state region. It predicted potential impacts on ambient air quality standards (NO_2, SO_2, PM_{10}, $PM_{2.5}$, and CO), PSD Class I increments, sulfur and nitrogen deposition, visibility in Class I areas, and potential impacts on sensitive lakes.

Among the analyzed alternatives, the common cumulative impacts for all alternatives included potential exceedances of the 24-hour PM_{10} standard in the near-field receptors in Montana. The exceedances were generally due to PM_{10} sources near mining operations; however, the method of analysis was not sufficiently detailed to provide a regulatory estimate of actual exceedances. The EIS analysis also reviewed PSD increments and noted potential impacts above the PSD levels, but did not specifically sort PSD increment consuming sources into their specific potential impacts The EIS noted that potential impacts among the alternatives are generally similar (Alternatives B, C, and E were stated to have similar potential impacts). The potential impacts of the alternatives under consideration were generally below applicable standards and increments, as well as having minimal potential impacts on visibility and acid deposition. The potential impacts of concern resulted from cumulative impacts of non-project sources that were analyzed in the study. All alternatives cumulative modeling showed visibility impacts at Class I areas, with the greatest potential impacts at the Northern Cheyenne Indian Reservation. Among the Class II areas reviewed, greatest potential impacts were at the Crow Indian Reservation, just west of the Northern Cheyenne Indian Reservation.

The Oil and Gas EIS identified existing air quality conditions in the region at the Morningstar, Badger Peak, and Lame Deer monitoring sites. The summary stated that The Oil and Gas EIS first identified existing air quality conditions in the region at the Morningstar, Badger Peak, and Lame Deer monitoring sites. The summary further stated that one monitor has shown that some 24-hour PM_{10} potential impacts exceed the ambient air quality standard of 150 $\mu g/m^3$, specifically at the Lame Deer monitoring site on the Northern Cheyenne Indian Reservation. Additionally, modeled near-field potential impacts in Wyoming showed the possibility of exceedences of the 24-hour PM_{10} standard and Class II PSD increments. Air quality levels of NO_2 and SO_2 were well below the ambient standards at all monitoring sites in the region.

The key emissions input data were based on emissions from the proposed alternatives along with other selected non-alternative sources in the region. A review of the database used in the study prepared by Argonne National Labs (Argonne 2002) indicated that actual emissions data that were modeled included: those sources operating after the monitoring period used to establish baseline air quality conditions; the changes in emission rates for some existing projects associated with the period of development of any of the alternatives; and project RFD scenarios and reasonably foreseeable future actions. Only those sources with changes in emissions, as reported by regulatory agencies, including WDEQ were included in the modeling. As a result, the modeling effort focused on potential impacts from new and altered permitted sources in the region. A series of alternatives was evaluated including Alternative A (which projected limited development under existing management prescriptions) and Alternatives B and D, which addressed various development scenarios and different measures that would influence air quality emissions. Other un-modified sources or potential emission rates were not modeled. The potential impacts from these sources were addressed by adding a background concentration to any analyses of the ambient air quality impacts for comparison to National and Montana Ambient Air Quality Standards.

Montana Near-field Receptors: For Alternative A, the projected potential impacts were modeled to be below the associated ambient air quality standards for all criteria pollutants except for the cumulative analysis of potential impacts on the 24-hour PM_{10} standard. The cumulative impact on the annual PM_{10} standard was estimated to be about 86 percent of the applicable standard (50 $\mu g/m^3$) for near-field and 66 percent at far-field receptors. Potential impacts from other pollutants were evaluated to be only a few percent of the applicable ambient standard, and

potential impacts from the proposed development were also well below the applicable Class II PSD increments. The potential impacts from Alternatives B-D showed slight increases in the PM_{10} impacts, but did not change the fact that the predicted 24-hour PM_{10} impact was above the established national and state ambient air quality standards. The potential impacts of other pollutants increased slightly, but did not exceed the ambient standards. Those impacts remained at just a few percent of the established standards.

Class I and Class II Sensitive Receptor Areas: The Oil and Gas EIS evaluated air quality potential impacts from criteria pollutants in the Class I and Class II areas with national and state ambient air quality standards and PSD increments. The results for Alternative A showed cumulative potential impacts exceeding the 24-hour PM_{10} ambient air quality standard in the near-field and the PSD increments in the near-field Crow Indian Reservation Class II area and the Northern Cheyenne Indian Reservation Class I area. The cumulative potential impacts from Alternatives B-D indicated similar exceedances of the 24-hour PM_{10} ambient air quality standard in near-field and PSD increment in near-field and Northern Cheyenne Indian Reservation receptors and the Washakie WSA. However, under Alternatives B and C, cumulative potential impacts were also predicted to exceed the annual NO_2 PSD increment on Northern Cheyenne Indian Reservation receptors. The air quality analysis does not represent a regulatory PSD increment consumption analysis.

The Oil and Gas EIS also addressed potential impacts on the Class I – Air Quality Related Values (AQRVs) including visibility, acid deposition, and acid neutralizing capacity at sensitive lakes. Potential impacts on visibility were evaluated in accord with the FLAG (2000) method which tabulated the number of days in which increased visibility impairment was greater than 10 percent of the background value at each receptor group. The results for Alternative A showed almost no impact from project development sources only; however potential impacts associated with non-project sources and cumulative impacts led to modeled impacts up to 25 and 28 days per year at Class I receptors to the east (predominately downwind) of the project area (Badlands National Park and Wind Cave National Park, respectively). Although the Northern Cheyenne Indian Reservation is designated as Class I for air quality, national visibility regulations do not apply to the Northern Cheyenne Indian Reservation Class I area because such regulations only apply to mandatory Class I areas. The maximum potential impacts on visibility show up to 42 days in which potential impacts were modeled at the Northern Cheyenne Indian Reservation. Among the Class II areas evaluated, the maximum potential impacts were noted for up to 69 days or more at the Crow Indian Reservation and up to 61 days at the Fort Belknap Indian Reservation.

The results for the other full development alternatives show modeled potential impacts at mandatory Class I areas for only 0-4 more days per year when emissions from all sources are considered. Potential impacts at the Northern Cheyenne Indian Reservation are up to 92 days per year and up to 116 days per year at the Crow Indian Reservation.

Acid Deposition: The Oil and Gas EIS evaluated potential impacts at identified sensitive lakes. The acid neutralizing capacity of each of the lakes was tabulated, and the predicted deposition of nitrogen and sulfur compounds was used to evaluate changes in acid neutralizing capacity at each lake. The guideline indicates that if the acid neutralizing capacity of a lake is above 25 micro-equivalents per liter (μeq/L) then a 10 percent change in acid neutralizing capacity is considered significant (USDA 2000, Fox et al. 1989). For lakes with lower acid neutralizing capacity a change of 1 μeq/L is considered significant.

Results showed that potential impacts were below the established thresholds for all lakes except Upper Frozen Lake in the Bridger Wilderness Area for all alternatives considered. For this lake, whose acid neutralizing capacity is less than 25 μeq/L, each alternative led to an increase of more than 1 μeq/L. For other lakes only Florence Lake in the Cloud Peak Wilderness Area showed a potential impact that was above the 10 percent change. Under Alternative B, C, and E, a cumulative increase of 10.4% was indicated.

Coal Review

As noted above, the Coal Review documented the air quality impacts of operations for coal development in the same region along with technical analyses of water and socioeconomic studies for potential coal development in the Montana and Wyoming Powder River Basin area. Figure 1-2 provides a depiction of the coal review study area and the associated receptor grids. Modeling results were presented for a base year (2002), using actual emissions and estimates of actual emissions and operations for that year. Modeling results were also presented for upper and lower reasonably foreseeable development scenarios, projected for 2010; and qualitative estimates of

potential impacts were provided for 2015 based on expected development of specified source groupings. The analyses evaluated potential impacts both within the PRB itself and at selected sensitive areas surrounding the region. The analysis specifically looked at potential impacts of coal mines, power plants, coal-bed methane development, and other activities. Results were provided for both Montana and Wyoming source groups and receptors.

The study area covers the CBNG development region in Montana. The technical air quality analysis effort focused on coal development, with additional assessment of CBNG development in Wyoming.

For the base year, results were provided as maximum potential impacts for receptor groups, including the near-field grid receptors, separately in Montana and Wyoming, and at the sensitive Class I and Class II receptor groups. This analysis provided the basis for making estimates of changes in future impacts. The analysis also provided potential impacts of acid deposition and visibility in the sensitive receptor areas, as well as assessment of changes in acid neutralizing capacity at identified sensitive lakes.

In general, the air quality in the region is very good, as demonstrated by measured levels of NO_2, SO_2, and PM_{10} with the exception of PM_{10} concentrations near coal mine operations. Both the monitored data and the modeled results for the base year study showed that there was a concern about ambient concentrations of PM_{10}, particularly for the 24-hour standard in the near-field receptor grid at receptors near coal mine operations in both Wyoming and Montana. This result was consistent with the modeled concentrations, which showed potential exceedances of the 24-hour PM_{10} standard for the base year. The Class I area potential impacts were evaluated to compare potential impacts to PSD increments as a threshold of concern and do not represent a regulatory PSD Increment Consumption Analysis.

At the Wyoming near-field receptors, the maximum potential impacts were associated with coal-related operations in Wyoming. Potential impacts of NO_2 and SO_2 were well below the ambient air quality standards for all receptors. For PM_{10} the analysis predicted potential impacts above the 24-hour PM_{10} National and Wyoming Ambient Air Quality Standard of 150 $\mu g/m^3$ at a few receptors near the mining operations. The base year maximum annual potential impacts were predicted to be below the annual PM_{10} standard of 50 $\mu g/m^3$. The maximum potential impacts were restricted to a few receptors near the mining operations, however.

Similar to the near-field in Wyoming, the projected potential impacts on NO_2 and SO_2 levels in Montana were well below the applicable state and federal standards. The predicted impacts on 24-hour PM_{10} levels were above the standard of 150 $\mu g/m^3$ at a few points near mining operations. The annual PM_{10} impact was predicted to be below the annual standards.

Of all the Class I areas that were analyzed, the maximum potential impacts were predicted to occur at the Northern Cheyenne Indian Reservation in Montana. The bulk of the potential impacts for all three criteria pollutants at Class I areas were caused by coal-related sources in Montana, and the bulk of the SO_2 impacts occurred from power plant emissions. All potential impacts were predicted to be below the ambient standards at all receptors for the base year. Of all the Class I areas that were analyzed, the maximum potential impacts were predicted to occur at the Northern Cheyenne Indian Reservation in Montana. Potential impacts at other Class I areas were also tabulated, but showed still lower impacts. At the nearest areas (Washakie Wilderness Area and Wind Cave National Park) impacts were generally a few percent of the ambient standards.

Among the sensitive Class II areas, the maximum potential impacts occurred at the Crow Indian Reservation in Montana. Potential impacts of NO_2 and SO_2 at sensitive Class II areas were again well below the ambient standards, but PM_{10} impacts were 20 percent of the 24-hour ambient standard and 6 percent of the annual PM_{10} standard. Among the sensitive Class II areas, the maximum potential impacts occurred at the Crow Indian Reservation in Montana.

Visibility potential impacts were analyzed for the indicated Class I and Class II areas. Using the CALPUFF modeling system, potential impacts were analyzed using the Method 6 approach, which uses monthly relative humidity values for each of the receptor groups. Potential impacts were assessed using the highest 24-hour calculated extinction within each receptor group, and were calculated as a percent change in extinction from a background value. The study tabulated the reduced visibility at the maximum impact receptor in each of the Class I and Class II groups. Results were presented as the number of days of annual visibility reduction of 5 percent and 10 percent of the background value. Maximum potential impacts were observed at Class I areas adjacent to the source area (the Northern Cheyenne Indian Reservation) and to the east of the PRB, specifically the Badlands National Park and the Wind Cave National Park. These receptor groups had maximum

modeled impacts above 10 percent degradation for 200 days or more per year.

Acid deposition potential impacts were analyzed for nitrogen and sulfur compounds for all the indicated Class I areas. For all areas, the combined deposition rates did not exceed the established thresholds of 3 kilograms per hectare per year (kg/ha-yr) for nitrogen compounds and 5 kg/ha-yr for sulfur compounds. The maximum deposition rates were observed at the Wind Cave National Park but all potential impacts were less than 10 percent of the established thresholds.

Eight separate lakes were identified as sensitive to acid deposition impacts, and were analyzed in accord with the screening methodology as provided by the US Forest Service. Data for lake acid neutralizing capacity were taken from the FS web site, which provides data for the 10 percent ANC values for the individual lakes. The threshold for significance was established at a change of 10 percent reduction for lakes with an acid neutralizing capacity of 25 micro-equivalents per liter (μeq/L) or more and a change of 1 μeq/L for lakes with less than 25 μeq/L acid neutralizing capacity. For the base year, all potential impacts were below the established thresholds, but were close to the established thresholds for Upper Frozen Lake in the Bridger Wilderness Area and at Florence Lake in the Cloud Peak Wilderness Area.

The Task 3A report for the Coal Review provided a modeling assessment of projected coal-related growth for 2010. Both a projected lower development scenario and an upper development scenario were analyzed. For coal-related sources, the overall projected growth in operations (and emissions) for the lower development scenario was about 13 percent in both Wyoming and Montana. For the upper development scenario, the projected growth from the base year was about 32 percent in Wyoming and 41 percent in Montana. The analyses included the foreseeable growth in power plant emissions, as a result of foreseeable additions to power generation. The Roundup Power Plant was not included directly in this analysis (although a separate evaluation of this individual source was conducted with the same modeling effort).

In comparison to the base year results discussed above, the following conclusions were made: For the near-field receptor grids, air quality modeling results showed that the predicted development continued to exacerbate the predicted air quality impacts for 24-hour PM_{10} and that the impacts on annual PM_{10} levels in Wyoming only would exceed the PM_{10} standard of 50 μg/m^3 at a few receptor points under the 2010 upper development scenario. Potential impacts of other pollutants increased with increased development, but the modeled impacts remained well below the ambient air quality standards.

The major potential impacts on Class I areas continued to occur at the Northern Cheyenne Indian Reservation. Predicted impacts were well below the ambient standards, but were above the PSD increments. At other Class I areas, only the 24-hour PM_{10} impacts were modeled to be above the PSD increments for the base year and for the 2010 upper and lower development scenarios.

At the modeled Class II receptor areas, the maximum potential impacts occurred at the Crow Indian Reservation. Predicted 24-hour PM_{10} impacts were above the PSD Class II increments (30.5 to 36.7 μg/m^3 versus a standard of 30 μg/m^3). Impacts at other Class II areas were below the established Class II increments.

At the identified Class I areas, the analysis identified the modeled increase in the number of days where potential impacts exceeded a 10 percent reduction in visibility. The major potential impacts occurred at Class I areas to the east of the PRB area, including, for the 2010 upper development scenario, an increase of 26 days per year at Badlands National Park, 22 days per year at Theodore Roosevelt National Park, and 15 days per year at Wind Cave National Park.

For sensitive lake impacts, modeled results showed changes in acid neutralizing capacity above 10 percent at Florence Lake for each of the 2010 scenarios, and an increase of more than 1 μeq/L at Upper Frozen Lake. These findings are consistent with the Oil and Gas EIS and with the base year Coal Review analysis. In general impacts at other lakes are well below the thresholds for significant impact.

Objective of This Study

The main objective of this study is to identify the changes in air quality impact resulting from the projected alternatives of development. Potential impacts are assessed at "near-field receptor grids" in both Wyoming and Montana and at the individual sensitive receptor areas as well. The impacts were evaluated for the same receptor set that was used in the Coal Review, using the same dispersion model and the receptor data. The near-field potential impacts refer to receptors in the Powder River Basin, near the projected development. Generally those receptors are within 50km of the development area.

The assessment included evaluation of potential impacts at all receptor groups on ambient air levels of nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter with aerodynamic diameter of 10 microns or less (PM_{10}), and selected hazardous air pollutants (HAPs). The HAPs were evaluated at the near-field receptors in Montana and Wyoming, but not at the sensitive receptor areas. At the sensitive receptor areas, potential impacts on visibility and acid deposition were also evaluated. The study evaluates the changes in potential impacts for each of these fields for the expected levels of development. The study includes evaluation of potential impacts at identified sensitive lakes in the region.

The study included development of emission rates and emission factors, or increases in emissions, for each of the source groups. Emission rates for CBNG development and conventional oil and gas development were based on data developed for the 2003 final EIS (Argonne 2002). Information from state agencies was utilized for development of the baseline year emissions from non-project sources.

Key Issues

Similar to the Coal Review, the key issues include the following:

- Characterizing emissions and controls. The emission source groups that were developed for the Coal Review form the basis for developing emission rates for this study, based on the changes in expected production for those source groups.
- Using representative meteorological data. Modeling was conducted using three years of gridded meteorological data, using the CALPUFF modeling system. The potential impacts of base year operations were modeled with all three years, and the year with the maximum impact was chosen for further modeling addressing the alternate development scenarios.
- Assessing nearby impacts. The evaluation of potential impacts in the PRB, using a "near-field receptor grid" is similar to the Coal Review Task 1A study. The study does not address the type of impact analyses that would be provided for obtaining an air permit for a specific facility. The focus is to provide a general depiction of overall potential impacts in the region.
- Assessing potential impacts on Class I and sensitive Class II areas. Class I sensitive areas require enhanced protection, based on federal law. The study evaluates potential impacts on ambient air quality standards, acid deposition, visibility, and identified sensitive lakes. The PSD increment consuming sources are not identified or modeled separately in this study. Therefore while the results are compared to the Class I and Class II PSD increments, no formal PSD evaluation is made.

Figure 1-1

Montana Statewide Oil and Gas EIS Study Receptor Grids and Modeling Domain

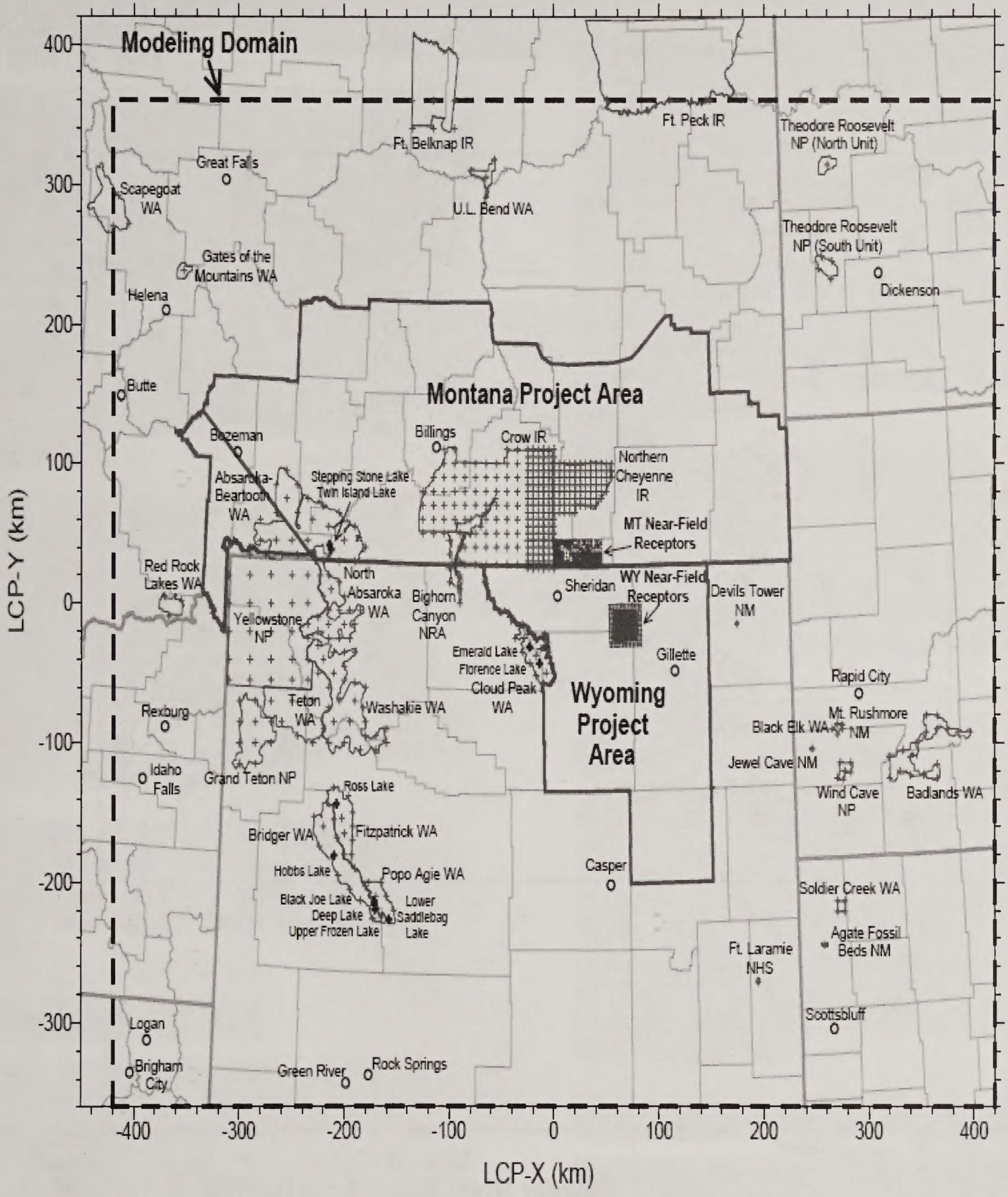
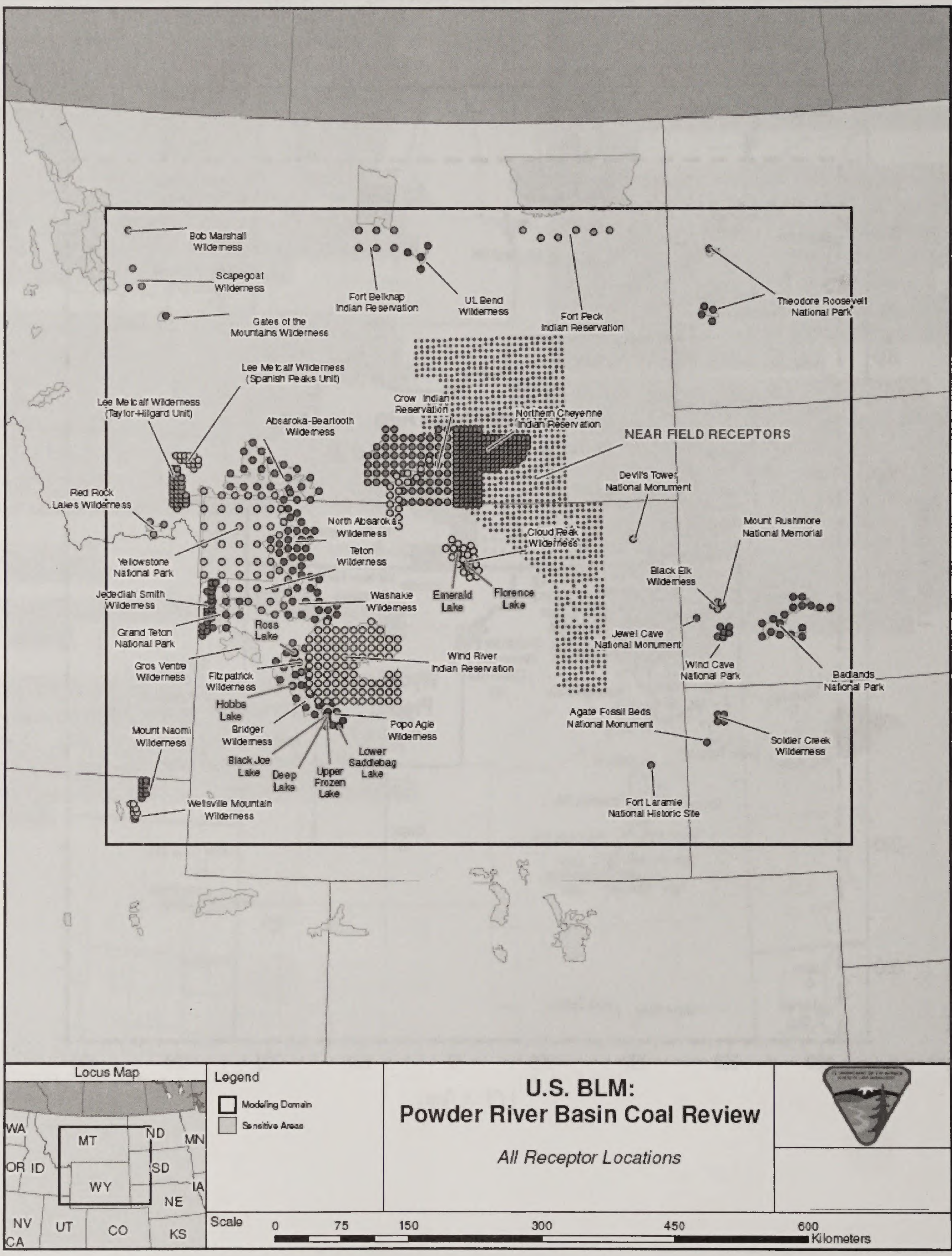


Figure 1-2

Coal Review Receptor Grids and Modeling Domain



2.0 TECHNICAL APPROACH

Overview of Assessment Approach

The objective of the study is to evaluate potential impacts over a wide range of receptors centered over the PRB study area. The evaluation covers receptors within the PRB in both Montana and Wyoming, and it includes individual sensitive receptor groups in the region surrounding the PRB study area. Key aspects of the assessment include the selection of air emissions within the study area, the selection of a modeling system to conduct that evaluation, the selection of a receptor set (within the model system) to be used for evaluating those potential impacts, and the selection of criteria for evaluation of those potential impacts.

This study addressed the impact of changes in emissions from a base year for three separate development scenarios. The assessment evaluated changes in air quality levels for NO_2, SO_2, PM_{10} and $PM_{2.5}$ at the identified receptors. The potential impacts from the development scenarios were assessed at all receptor groups. The study analyzed the potential impacts from identified separate source groups, which allowed a characterization of potential impacts from the individual groups.

This section provides a detailed review of the modeling system, the emissions characterization, the receptor grids that were used, and the assessment criteria that were used for evaluation of potential impacts.

Air Quality Modeling

To conduct a formal modeling of those potential impacts, the USEPA guideline model CALPUFF (Scire, et al. 2000) was used to estimate potential impacts in both the PRB receptors and the sensitive surrounding areas. The CALPUFF modeling system was recommended for a refined modeling analysis of the region in order to assess potential impacts over near-field and distant receptor areas. The CALPUFF modeling system has three main components:

- CALMET (a diagnostic three-dimensional meteorological model, which develops the meteorological data for modeling input);
- CALPUFF (the transport and dispersion model that carries out calculations of dispersion);
- CALPOST (a post processing package that is used to depict overall concentrations and potential impacts).

The CALPUFF modeling system is designed to treat the time-varying point and area source emissions, model domains at distances from tens of meters to hundreds of kilometers from the sources; predict averaging times from 1 hour to 1 year; predict impacts for inert pollutants that are not chemically changed in the atmosphere; predict potential impacts of pollutants that may be subject to removal and chemical conversion mechanisms; and be applied to rough terrain situations. Given these strengths and the objectives of the study, the CALPUFF model is aptly suited to carrying out the required atmospheric dispersion modeling.

The CALPUFF modeling domain for the PRB Coal Study was established to be identical to that used in the PRB Oil and Gas Final EIS (BLM 2003) and the base year study that is part of the overall coal review (ENSR 2005a,b). A depiction of the CALPUFF modeling domain, along with the depiction of the study area and sensitive receptors, is provided in Figure 1-2.

The CALMET input files were developed from the regional MM5 data base for 2001, 2002, and 2003. All three years were used to develop the potential impacts for the base year (2004 emissions). The study first analyzed the potential impacts for all three years for the base year, focusing on potential impacts in the near-field. A comparison of the potential impacts from those three years concluded that the year 2002 would provide the highest potential impacts in the near-field. For each of the development scenarios, the potential impacts were then analyzed using only 2002 meteorological data.

Receptor Grids and Analyses

Receptor grids were established for both near-field and far-field areas (sensitive Class I and Class II areas of concern). These included the near-field receptors in both states, which cover the study area in each state. The receptor grids are the same as those in the Coal Review, as shown in Figure 1-2. The near-field grid receptors cover grid points within the boundaries of the PRB development area. Near-field receptors were arranged to obtain the maximum

estimated concentrations that result from development within the PRB.

The purpose of establishing the near-field receptors is to characterize the overall air quality conditions in the PRB as a result of this development, but not to focus on potential impacts from any one individual source. This approach does NOT address the modeling that would be needed for assessing potential impacts at any facility fence lines, which is generally required for obtaining an air permit from a regulatory agency. Consequently, all near-field receptors that were located within 1 km of a modeled source were removed from the near-field grid. Overall the near-field receptor grid points were spaced at 1-km intervals over the study area. The elevation of each receptor was obtained from the USGS Digital Elevation Model data for the 1:250,000 quads with 90-meter horizontal resolution.

Receptors spaced at 1-km intervals were located along boundaries of Class I and Class II areas and receptors spaced at 2-km intervals were located within each of the following Class I and specified Class II sensitive areas of concern within the modeling domain:

- Badlands National Park
- Wind Cave National Park
- Bridger Wilderness Area
- Fitzpatrick Wilderness Area
- Washakie Wilderness Area
- North Absaroka Wilderness Area
- Northern Cheyenne Indian Reservation (Class 1, Northern Cheyenne Tribal Council)
- Devils Tower National Monument
- Mount Rushmore National Memorial
- Jewel Cave National Monument
- Agate Fossil Beds National Monument
- Fort Laramie National Historic Site
- Black Elk Wilderness Area
- Soldier Creek Wilderness Area
- Cloud Peak Wilderness Area
- Yellowstone National Park
- Grand Teton National Park
- Teton Wilderness Area
- Absaroka Beartooth Wilderness Area
- Bighorn Canyon National Recreation Area
- Popo Agie Wilderness Area
- Crow Indian Reservation (Class II, Crow Tribal Council)
- Theodore Roosevelt National Park

The following areas are near the edge of the modeling domain. Modeled impacts at receptors within these areas near the edge of the modeling domain might be associated with model inaccuracies and uncertainties due to edge effects of the modeling. Therefore, estimates of potential impacts to these areas near the edge of the modeling domain were made by placing representative receptors no nearer than 25 km from the edge of the modeling domain:

- Bob Marshall Wilderness Area
- Gates of the Mountains Wilderness Area
- Lee Metcalf Wilderness Area, Spanish Peaks Unit
- Lee Metcalf Wilderness Area, Taylor Hillgard Unit
- Red Rock Lakes Wilderness Area
- Jedediah Smith Wilderness Area
- Mount Naomi Wilderness Area
- Wellsville Mountain Wilderness Area
- U.L. Bend Wilderness Area
- Fort Peck Indian Reservation (Class I, Fort Peck Tribal Council)
- Scapegoat Wilderness Area
- Fort Belknap Indian Reservation.

These locations as well as other sensitive receptors, such as lakes are indicated in Figure 1-2. The receptors were spaced with sufficient density to assure that the maximum potential air quality impacts are evaluated. All sensitive receptors were identified and reviewed in the modeling protocol by the stakeholder group, prior to initiating the modeling.

Emissions Input Data

Source characterization and emissions data are key inputs to conducting a successful modeling analysis. The bulk of the emissions data were provided by the regulatory agencies (Wyoming Department of Environmental Quality, or WDEQ, and the Montana Department of Environmental Quality, or MDEQ). Emissions data for major sources in nearby states, which are also within the model grid, were obtained from the individual state regulatory agencies (Idaho, Utah, Nebraska, South Dakota, and North Dakota).

Emissions Source Groups

Similar to the Coal Review, the emission sources for the study were separated into various emission source groups, which were analyzed separately. The emission source groups that were analyzed focused on certain air pollutant emissions including SO_2, NOx, and PM_{10}. The emission source groups that were analyzed also focused on certain hazardous air pollutant (HAP) emissions including benzene, n-hexane, toluene, ethyl-benzene, xylene and formaldehyde. The study also included a group of major sources that were identified by the Environmental Defense Fund (and others) in response to the analyses in the Montana Statewide EIS. The following emission source groups were analyzed as part of this study:

- All sources combined;
- CBNG sources;
  - CBNG production, separately for each state
  - CBNG operation, separately for each state;
- Conventional oil and gas sources;
- Coal-related sources (from both states, including power plants and conversion facilities) ;
- Coal mines (in both states) ;
- Montana sources (all sources located in Montana not otherwise identified);
- Wyoming sources (all sources located in Wyoming not otherwise identified);
- Non-coal sources (roads, railroads, urban areas, miscellaneous sources, all sources in ID, UT, NE, SD, ND) ;
- Environmental Defense Fund (EDF) identified sources; and
- Power plants (includes coal- and gas-fired power plants in Wyoming and Montana).

Base Year Selection

At the start of the project the year 2004 was selected as a base year for determining current emissions and potential impacts. The 2004 data were readily available, and the year coincided with the emissions inventory being collected by the Western Regional Air Partnership (WRAP). Emission rates for 2004 were calculated in different manners for each emission source group. Emission rates for the projected development scenarios were estimated for the year with the expected maximum emissions from the development scenarios. For this effort, the 20th year of projected development was used, as discussed below. The methodology used to calculate emission rates for each emission source group is as follows.

Alternative Development Year

The purpose of this effort is to characterize maximum emissions from selected alternate development scenarios over an extended period in the future, and to evaluate the comparative potential impacts from the emissions associated with each alternate development scenario when considering approval of any of those alternatives. This study will use projected emissions for each scenario as input into the dispersion model. The alternative development year (ADY) that was used for evaluation of alternatives was selected based on the total maximum emissions from the Montana CBM construction and operation combined for each of the alternatives over a 20 year span.

Data shown in Table 2-1 provide the total emissions from well construction and operations, and total emissions from the combined sources for each alternative. The table shows the maximum potential impacts are likely to occur in year 20 or 21 of this analysis (2026 or 2027) for all alternatives. Construction emissions peak in Year 4, but operational emissions are much larger and therefore dominate the emission pattern. Details of the total emissions are provided in the Air Quality Modeling Technical Support Document (ALL 2006). Based on the emissions data presented in Table 2-1, Year 20 was selected as the ADY for which potential impacts are modeled in this report. For the base year (2004) and the ADY (Year 20), a set of emission factors and emission rates for each of the identified source groups was developed, as described below.

Emissions by Source Group

This section summarizes the calculation of emissions for each source group identified above. Both the base year and ADY are included in this discussion.

Coal Bed Natural Gas Sources

As shown in Table 2-1, the coal bed natural gas (CBNG) production sources form the basis for conducting the evaluation. For this study, projected CBNG development was provided for the Montana area study by watershed area. Each of the watersheds was identified and a level of CBNG development was assigned to each watershed, including both well development/construction and well operation in year 20. Emissions from the well development and operation were calculated based on the number of

wells in each category, using emission factors that were developed for Table 2-1.
A total of 15 separate watersheds are included in this analysis, for each of the three alternative development scenarios that are under consideration. Table 2-2 lists each alternative, along with projected development and associated emission rates for each watershed. The total wells and emissions are also provided for each alternative.

Among the alternatives, there are different development rates in several of the watersheds. In the Rosebud watershed, the maximum operation wells occur in Alternative E, with less in Alternatives F and H respectively. The Lower Yellowstone Sunday and Upper Yellowstone Lake B combined had greater development in Alternative E than in any of the other alternatives.

Overall Alternative E had greater development in terms of operational wells, but the least in terms of wells under construction. In general the development from Alternative E through Alternative H showed an increase in the number of wells under construction. Other relevant development data is presented in Tables 2-1 and 2-2.

To conduct the modeling, the emissions from each watershed were assigned to 5 separate point sources within each watershed, using representative stack parameters for oil and gas development.

Table 2-1
Total Annual Emissions for Alternatives Under Consideration

Year	Alternative E			Alternative F			Alternative H		
	Sum Total Emissions Oper (Tons)	Sum Total Emissions Const (Tons)	Sum Total Emissions All (Tons)	Sum Total Emissions Oper (Tons)	Sum Total Emissions Const (Tons)	Sum Total Emissions All (Tons)	Sum Total Emissions Oper (Tons)	Sum Total Emissions Const (Tons)	Sum Total Emissions All (Tons)
1	536	1917	2454	357	1277	1634	357	1276	1633
2	1717	2303	4021	1250	1915	3166	1250	1914	3164
3	3543	4220	7762	2419	2261	4679	2419	2263	4681
4	6009	4596	10605	3740	2461	6201	3744	2473	6217
5	8476	4220	12696	5080	2260	7340	5069	2263	7332
6	10516	3070	13586	6255	1914	8169	6261	1999	8260
7	12126	2684	14810	7333	1916	9249	7356	1914	9271
8	13413	1917	15331	8412	1914	10326	8428	1914	10342
9	14486	1918	16404	9490	1914	11404	9499	1914	11413
10	15452	1532	16984	10568	1914	12482	10570	1914	12485
11	16202	1151	17353	11644	1915	13559	11642	1914	13556
12	16846	1151	17998	12713	1905	14618	12713	1914	14627
13	17490	1150	18641	13731	1734	15465	13784	1914	15699
14	18134	1150	19285	14702	1735	16437	14856	1914	16770
15	18778	1151	19929	15673	1735	17407	15927	1914	17842
16	19368	959	20327	16573	1482	18055	16998	1914	18913
17	19905	957	20862	17401	1479	18880	18040	1809	19850
18	20441	960	21400	18200	1377	19578	19018	1683	20701
19	20924	766	21690	18906	1143	20049	19930	1578	21508
20	21457	571	22028	19487	935	20422	20754	1367	22122
21	0	0	0	19691	1070	20761	21071	575	21646
22	0	0	0	19032	1043	20075	0	0	0
23	0	0	0	17198	1049	18247	0	0	0

Coal Production Related Sources

For coal production related sources, which included mines, mine roads, railroads, and coal conversion sources, the base year data (2004) was used to establish the baseline emissions. Coal production estimates were obtained from analyses of the Coal Review, and those estimates were used to change total coal-related mining sources Total coal development was based on the Coal Review. Emissions for the ADY were based on coal development projections and applied to both Montana and Wyoming.

Figure 2-1 provides a graphical representation of the expected changes in coal production over the next two decades. The Coal Review provided an updated coal production scenario for 2004 and 2020. The coal average values of the coal production increase from 380 million tons/year in 2004 to 580 million tons/year in 2020. This ratio (1.53) was applied to coal development in Wyoming and Montana from the base year to the ADY.

Conventional Oil & Gas Sources

For conventional oil and gas sources, the baseline year data (2004) was used to establish the baseline emissions. The number of operating wells and the number of conventional oil and gas production levels for the base year and for the ADY were obtained from available data (MBOGC 2006). Emissions estimates include both operating wells and well construction as indicated in the Table 2-3. The emission factors shown in Table 2-3 were developed from a combination of data sources, and the factors represent the emissions in ton/year that would be emitted by either well construction or well operation. For the ADY, the total number of wells, including operation and construction are also indicated. The table shows the dramatic increase in the number of operating wells, but a slight reduction in the number of wells being constructed. Overall, emissions of NO_X from this source group would decline about 109 ton/year from the base year to the ADY. Emissions of PM_{10} would increase slightly and emissions of SO_2 would decrease slightly from the base year.

To conduct the modeling effort, the locations of the emissions sources were assigned to five separate point sources within each of the indicated counties. No specific site location data were available, and therefore this approach represented a suitable approximation for the modeling effort.

Power Plant Sources

For coal-fired power plants, the projected ADY emission rates for power plants that were not operational in 2004 but are expected to be operational in the ADY were derived from the actual power plant permit applications or the power plant permits from the specified facility. This should allow for a conservative estimate since the permitted emission rates will be the allowable emission rates, and actual emission rates from these new power plants could be less than the allowable emissions but cannot be higher. Where stack parameters were available, those data were used for input into the modeling. Emissions of NO_x, SO_2, and PM_{10} from the power plant permits were determined from expected levels of best available control technology (BACT) that would be applied to those sources. If a coal-fired plant permit application or permit was not obtainable, emissions from a coal-fired plant of the equivalent size was used to estimate emissions. The coal-fired power plants for which emissions were estimated for the ADY include the following:

- WYGEN2
- Two Elk Unit 1
- Basin Electric / Gillette
- Hardin Generating Station
- Roundup Power Plant
- Great Falls Power Plant

These coal-fired power plants are included as individual sources, in addition to the existing coal-fired facilities which were also analyzed. For existing coal-fired power plant sources that were operational in 2004, to account for a possible increase in capacity between the baseline year to ADY, a scaling factor was used to increase the capacity of these sources from 88% capacity factor in 2004 to a 90% capacity factor in the ADY.

Table 2-2
Summary of Total Emissions by Watershed
Year 20 of Development

Alternative E

Watersheds	Operational Wells	Construction Wells	NOx Emissions (Tons)	PM10 Emissions (Tons)	SO2 Emissions (Tons)	VOC Emissions (Tons)
Upper Tongue	5024	0	1930	424	37	2141
Lower Tongue	4503	0	1730	380	33	1919
Middle Powder	2741	0	1053	231	20	1168
Little Powder	261	0	100	22	2	111
Rosebud	4698	0	1805	396	35	2003
Mizpah	163	0	63	14	1	70
Clarks Fork Yellowstone	587	0	226	50	4	250
Lower Yellowstone Sunday	2219	0	852	187	16	946
Upper Yellowstone Lake B	1045	93	490	121	14	453
Little Bighorn	881	100	433	110	13	384
Lower Bighorn	1043	121	516	131	15	455
Middle Musselshell	131	9	59	14	2	57
Upper Yellowstone Pompeys	262	35	133	34	4	114
Stillwater	131	23	72	19	2	57
Upper Musselshell	98	13	50	13	2	43
TOTAL	23787	394	9511	2145	201	10170

Alternative F

Watersheds	Operational Wells	Construction Wells	NOx Emissions (Tons)	PM10 Emissions (Tons)	SO2 Emissions (Tons)	VOC Emissions (Tons)
Upper Tongue	5024	0	1930	424	37	2141
Lower Tongue	4440	139	1838	424	42	1904
Middle Powder	2638	122	1129	266	27	1134
Little Powder	261	0	100	22	2	111
Rosebud	4515	198	1923	451	46	1941
Mizpah	164	0	63	14	1	70
Clarks Fork Yellowstone	653	0	251	55	5	278
Lower Yellowstone Sunday	1565	49	648	149	15	671
Upper Yellowstone Lake B	687	57	318	78	9	298
Little Bighorn	582	20	242	56	6	250
Lower Bighorn	663	35	288	68	7	286
Middle Musselshell	89	3	37	9	1	38
Upper Yellowstone Pompeys	173	12	77	19	2	75
Stillwater	85	6	38	9	1	37
Upper Musselshell	63	4	28	7	1	27
TOTAL	21602	645	8911	2050	201	9260

Table 2-2 (Continued)

Alternative H						
Watersheds	**Operational Wells**	**Construction Wells**	**NOx Emissions (Tons)**	**PM10 Emissions (Tons)**	**SO2 Emissions (Tons)**	**VOC Emissions (Tons)**
Upper Tongue	5024	0	1930	424	37	2142
Lower Tongue	4502	0	1730	380	33	1919
Middle Powder	2741	0	1053	231	20	1168
Little Powder	261	0	100	22	2	111
Rosebud	4263	322	1944	474	52	1843
Mizpah	164	0	63	14	1	70
Clarks Fork Yellowstone	587	0	226	50	4	250
Lower Yellowstone Sunday	2219	0	852	187	16	946
Upper Yellowstone Lake B	841	303	611	179	26	383
Little Bighorn	882	0	339	74	7	376
Lower Bighorn	1044	0	401	88	8	445
Middle Musselshell	86	100	128	43	7	45
Upper Yellowstone Pompeys	163	218	270	91	15	87
Stillwater	131	0	50	11	1	56
Upper Musselshell	99	0	38	8	1	42
TOTAL	23007	943	9734	2275	231	9882

Figure 2-1
Projected Coal Development for PRB Wyoming

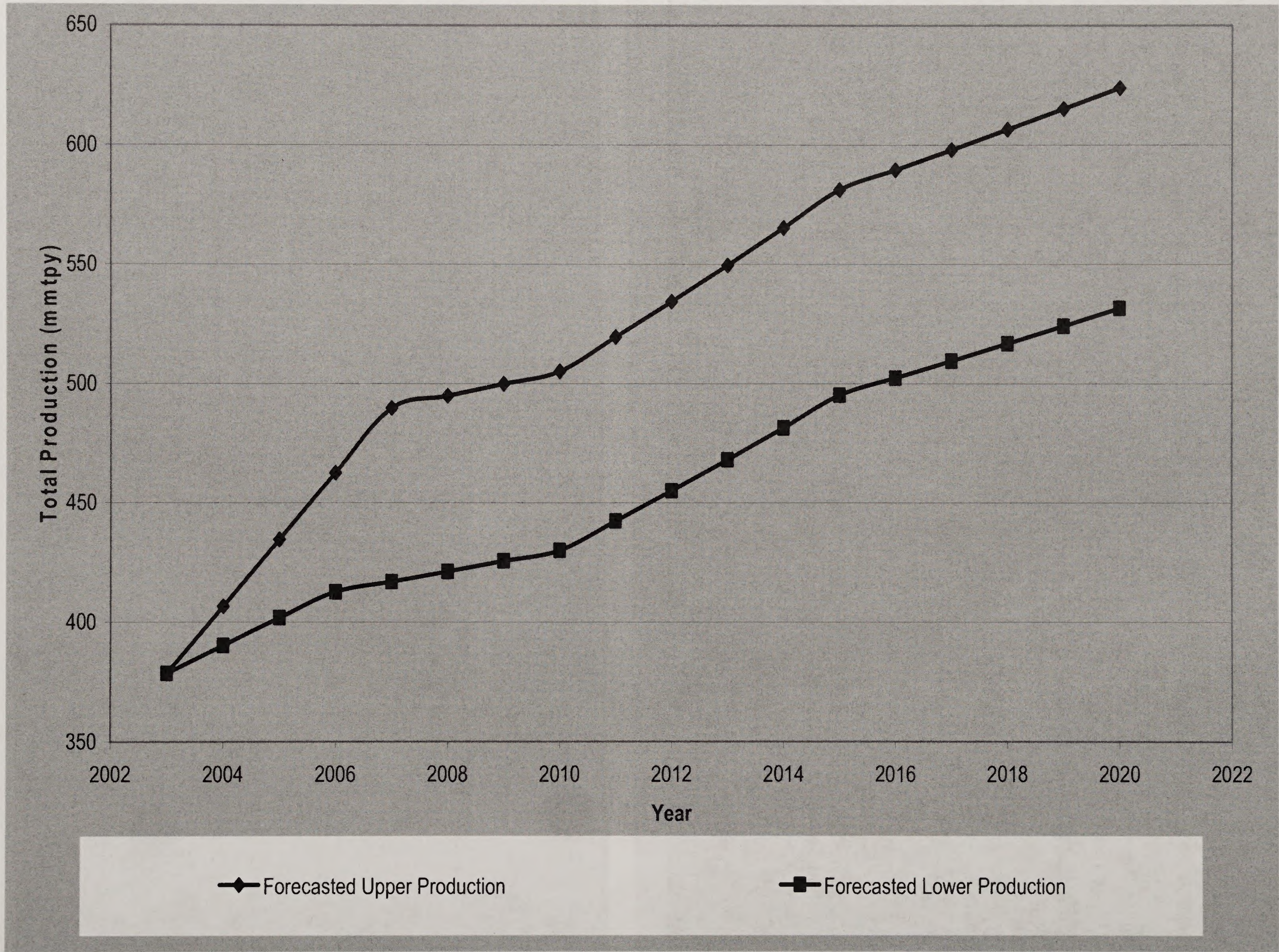


Table 2-3
Base Year 2004 and Alternative Production Year (Year 20) Emissions
Montana Conventional Oil and Gas Operation and Construction

Base Year	County	Wells Oper	Wells Const	NOx Emissions Oper (Tons)	NOx Emissions Const (Tons)	PM10 Emissions Oper (Tons)	PM10 Emissions Const (Tons)	SO2 Emissions Oper (Tons)	SO2 Emissions Const (Tons)
2004	Big Horn	46	2	1.22	18.99	0.99	1.67	0.09	2.34
2004	Carbon	99	7	2.62	66.47	2.14	5.85	0.19	8.20
2004	Custer	4	0	0.11	0.00	0.09	0.00	0.01	0.00
2004	Golden Valley	2	0	0.05	0.00	0.04	0.00	0.00	0.00
2004	Musselshell	74	20	1.96	189.90	1.60	16.70	0.14	23.42
2004	Powder River	57	5	1.51	47.48	1.23	4.18	0.11	5.86
2004	Rosebud	96	10	2.54	94.95	2.07	8.35	0.19	11.71
2004	Stillwater	16	9	0.42	85.46	0.35	7.52	0.03	10.54
2004	Sweetgrass	5	3	0.13	28.49	0.11	2.51	0.01	3.51
2004	Yellowstone	28	5	0.74	47.48	0.60	4.18	0.05	5.86
2004	Carter	0	12	0.00	113.94	0.00	10.02	0.00	14.05
2004	Wheatland	0	0	0.00	0.00	0.00	0.00	0.00	0.00
2004	Treasure	0	0	0.00	0.00	0.00	0.00	0.00	0.00
	TOTAL	427	73	11.30	693.15	9.21	60.96	0.82	85.49
	Emission Factors			0.0264573	9.4951754	0.0215694	0.8350877	0.0019282	1.1710526
ADY[1]									
20	Big Horn	230	6	6.08	60.64	4.96	5.33	0.44	7.48
20	Carbon	230	6	6.08	60.64	4.96	5.33	0.44	7.48
20	Carter	115	3	3.04	30.32	2.48	2.67	0.22	3.74
20	Custer	69	2	1.82	18.19	1.49	1.60	0.13	2.24
20	Golden Valley	34	1	0.91	9.10	0.74	0.80	0.07	1.12
20	Musselshell	402	11	10.65	106.12	8.68	9.33	0.78	13.09
20	Powder River	345	10	9.12	90.96	7.44	8.00	0.67	11.22
20	Rosebud	345	10	9.12	90.96	7.44	8.00	0.67	11.22
20	Stillwater	115	3	3.04	30.32	2.48	2.67	0.22	3.74
20	Sweetgrass	23	1	0.61	6.06	0.50	0.53	0.04	0.75
20	Treasure	11	0	0.30	3.03	0.25	0.27	0.02	0.37
20	Wheatland	17	0	0.46	4.55	0.37	0.40	0.03	0.56
20	Yellowstone	115	3	3.04	30.32	2.48	2.67	0.22	3.74
	TOTAL	2052	57	54.29	541.23	44.26	47.60	3.96	66.75
	NET CHANGE	1625	-16	42.99	-151.92	35.05	-13.36	3.13	-18.74

1 – ADY – Alternative Development Year

Other Major Sources

This analysis included emissions from other major sources in both Montana and Wyoming as wells as nearby states, which are located within the modeling domain as presented above. Each regulatory agency in Idaho, Utah, Nebraska, South Dakota, and North Dakota were contacted to obtain emissions data for sources with major operating permits (as required under Title V of the Clean Air Act Amendments of 1990). Locations and stack parameters were taken from available source data. Emissions data for 2004 were used for most cases, but for some instances, the potential emissions were used. In addition for some sources with multiple emission sources, the total source emissions were characterized as a single point for the whole facility. These sources were all over 400 km from the near-field grids in Montana and Wyoming, and such characterizations would not affect the potential impacts at these distant receptors.

The other sources included all the sources in the domain that were identified by the Environmental Defense Fund in its comments on the Montana Statewide Oil and Gas EIS.

As a convenience in interpreting the modeling, source potential impacts were grouped in several components, including all Montana sources, all Wyoming sources, railroad data, etc. In addition the Tongue River Railroad projected emissions were included. Emissions were developed for points along the segments of the railroad, with emission rates per mile developed from the Tongue River Railroad EIS.

For these other sources there was no adjustment to the emission rates from the baseline year to the alternative development year (ADY). The modeled location for the projections did not change from the baseline modeling for any sources except for the CBM development, conventional oil and gas development and new power plants.

Ambient Air Quality During the Base Year

Ambient air quality conditions in Montana for 2004 were generally very good. Reported data as provided on the USEPA AIRS data base (www.epa.gov/air/data/reports.html) for 2004 were downloaded and are summarized for each pollutant below.

PM_{10}

A total of 40 separate PM_{10} monitors were installed and operated in Montana in 2004. The applicable standards are 150 $\mu g/m^3$ for the second-highest 24-hour level and 50 $\mu g/m^3$ for the annual average.

In Big Horn County 8 separate monitors operated, with the highest second-highest 24-hour PM_{10} level of 82 $\mu g/m^3$ at Decker Coal #1 and the highest annual level of 25 $\mu g/m^3$ at Decker Coal #7. For background concentrations, the 4th highest 24-hour level was 28 $\mu g/m^3$ at Decker Coal #5 and the lowest annual average was 14 $\mu g/m^3$ at two sites.

In Rosebud County, one station operated at Lame Deer (intersection of Highways 212 and 39). The second highest 24-hour PM_{10} level was 48 $\mu g/m^3$, with an annual average of 22 $\mu g/m^3$.

In Yellowstone County (Billings) there were two operating PM_{10} monitoring sites. At these two sites, second highest 24-hour monitored level was 38 $\mu g/m^3$ and the annual averages were 16 and 21 $\mu g/m^3$ respectively.

$PM_{2.5}$

A total of 21 separate $PM_{2.5}$ monitoring sites were installed and operating in 2004, with two at Lame Deer and one in Billings (in the study area). The 24-hour standard is met by evaluating the 98th percentile of the highest concentrations for all the collected 24-hour samples. At Lame Deer Site 1, there were 114 observations and the 98th percentile value would be the 111th (fourth highest) reading. The fourth-highest 24-hour $PM_{2.5}$ level at that site was 16 $\mu g/m^3$ compared to a standard of 65 $\mu g/m^3$ (proposed to be 35 $\mu g/m^3$). At the second Lame Deer Site, there were 25 readings taken, and the second highest reading (98th percentile) was 11 $\mu g/m^3$. In Billings there were 116 observations, and the fourth-highest 24-hour reading was 19 $\mu g/m^3$. The annual average $PM_{2.5}$ levels were 5.8 and 5.9 $\mu g/m^3$ at the two Lame Deer sites, and 8.2 $\mu g/m^3$ in Billings, versus an annual arithmetic average standard of 15 $\mu g/m^3$.

NO_2

NO_2 was measured at three sites in Montana in 2004, with all three sites in Rosebud County. The Montana 1-hour standards (not to be exceeded more than once per year) is 0.5 ppm, and the actual readings were 0.027, 0.027, and 0.029 ppm at the three sites. The Montana and federal ambient standard is 0.053 ppm and the measurements for annual average at all three

Rosebud County sites was 0.003 ppm. Ambient levels are well below the applicable standards. The annual average reading is about 6 percent of the annual standard.

SO_2

A total of 13 SO_2 monitoring stations operated in Montana in 2004. Three were in Rosebud County and nine were in Yellowstone County. The Yellowstone observations are not discussed here, because they reflect impacts of nearby major SO_2 sources (although all readings are below applicable ambient standards). In Rosebud County, the highest second-highest 1-hour SO_2 readings are 0.007, 0.013, and 0.016 ppm respectively, against a Montana-only 1-hour standard of 0.5 ppm. The highest second-highest 3-hour values are 0.003, 0.006 and 0.007 ppm respectively compared to a standard of 0.5 ppm. The highest second-highest 24-hour averages are 0.002, 0.003, and 0.004 ppm respectively, compared to an ambient standard of 0.14 ppm. For the annual average, all Rosebud measurements are 0.001 ppm, compared to an annual average standard of 0.03 ppm. Results show that for the Rosebud County area, the actual levels are about 3 percent of the standards or less. Current SO_2 conditions in the study area are very clean.

3.0 MODELED RESULTS FOR BASE YEAR AND ALTERNATIVE DEVELOPMENT SCENARIOS

Using the model and source groups discussed in Chapter 2, the modeling effort evaluated the three meteorological years (2001, 2002, and 2003) by modeling potential impacts of each of the source groups for the base year (2004). Potential impacts from the base year study showed that maximum potential impacts occurred with the 2002 meteorological data. Further analyses for the three development alternatives then used the 2002 meteorological data only for assessing potential impacts.

A summary of the key findings for each of the air quality components is provided in Table 3-1. The detailed analysis for each of the components is provided in this Chapter. In general the results of this modeling study are consistent with the findings of the Coal Review and the Oil and Gas EIS.

Impacts on Ambient Air Quality

Using the receptor grids identified in Chapter 2 along with the source groupings, the model was used to predict the potential impacts at each receptor point in the receptor grid. For this analysis, the results are provided for the maximum receptor in each group, which may not be the same receptor in each of the modeling scenarios. Potential impacts may occur at different receptors for each of the modeling scenarios, but those changes in maximum receptor are not identified in these results.

The analysis does not separate the sources into PSD increment-consuming and non PSD increment consuming sources. Therefore the results cannot be used to develop a pattern of increment consumption for a particular site. The PSD comparisons are for disclosure of potential impacts and identification of potential areas of concern only and do not constitute a regulatory PSD increment consumption analysis, which may be required for specific projects by air permitting authorities.

The model results are also limited by certain assumptions regarding sources and receptors. The source characterizations are based on available data, and do not represent specific stacks or sources of fugitive emissions. The modeling sources are generally provided by area or volume, to represent multiple sources within each specified unit. The specific fence lines or exclusion areas around a modeled source are also not specifically identified in this study. The results cannot, therefore, be interpreted as evaluating maximum potential impacts that might occur at the boundary or fence line of a specific source. The receptors in the near-field grid in both states were removed from modeling if their location was within 1 km of any source.

Table 3-1
Summary of Modeled Air Quality Impacts

Air Quality Component		**Alternate Development Year Impacts (includes modeled base year emissions)**
Concentrations	Criteria	Below NAAQS and state AAQS, except near-field PM10
	HAPs	Less than RELs and RfCs, except for benzene
Visibility	Far-field	Class I areas have greater than 200 days with greater than 1 dv, maximum impacts not affected by scenarios E, F and H.
Atmospheric Deposition Sulfur	LOC	Below 5 kg/hectare-year
Atmospheric Deposition Nitrogen	LOC	Below 3 kg/hectare-year
Atmospheric Deposition Lake Chemistry	ANC	Development raises impacts above LAC for two lakes.

Impacts at Near-field Receptors in Montana

Results are provided for the near-field receptor grid for Montana in Figure 3-1. The figure shows the potential impacts at the maximum receptor for each modeling scenario: the base year, and the maximum potential impact for each of the alternative scenarios. The potential impacts on that receptor group are depicted for all sources and the potential impacts that result from the individual source groups are identified in Figure 3-1. Data are provided for each ambient standard and PSD increment for NOx, SO_2 and PM_{10}. Specific data are provided in The Air Quality Model Technical Support Document (ALL 2006), for air quality impacts at all receptor groups. In this presentation, the impact from one source group would not likely be at the same receptor as that of the other source group; therefore the results for each group are not arithmetically additive to obtain an overall impact.

The results show a predicted impact from the Tongue River Railroad emissions for the 1-hour Montana NO_2 standard, about 50 percent of that standard. This result may be due partially to the relationship between the source characterization and the receptor grid. The Tongue River Railroad is presumed to operate in the ADY.

The potential impacts from all sources on the near-field receptor grid do increase over the base year, but overall the NOx emissions from the alternatives show a higher impact for Alternative E than for the other alternatives for the one-hour standard. When evaluating the potential impacts of the alternatives alone, the emissions do not lead to substantial differences among them for the annual or 1-hour NO_2 potential impacts. This discrepancy can be explained by the areal distribution of potential impacts, which for Alternative E would include areas already impacted by existing sources.

For the annual NO_2 potential impacts in Montana the Tongue River Railroad and the CBNG operation play the major role, but are clearly well below the NAAQS and even the comparative PSD annual NO_2 increment. These data are provided for comparison only and do not represent a regulatory PSD Increment Consumption Analysis.

Figure 3-1 also provides results for PM_{10}, $PM_{2.5}$ and SO_2. The results show a relatively high impact from the Tongue River Railroad and from MT CBM operations but all potential impacts are well below any standards. The NO_2 potential impacts would be the major concern regarding the development of the alternatives, on the Montana near-field grid.

Impacts at Near-field Receptors in Wyoming

Results for the Wyoming near-field receptors are provided in Figure 3-2. In Wyoming the coal operations led to modeled impacts on PM_{10} levels that are above the NAAQS for the 24-hour period (150 $\mu g/m^3$), for the base year as well as for ADY. The modeled impacts are nearly double the standard for the base year scenario. The remaining data show that potential impacts are well below the ambient air quality standards. The Wyoming coal operations are largely responsible for the predicted impacts for all scenarios, although non-coal sources do contribute a notable portion of the impact.

The potential impacts of NO_2 are generally about 40 percent of the annual standard, with no real difference for the alternatives analyzed in the ADY. The coal sources are the largest contributor to the maximum NO_2 potential impacts, however, CBNG and non-coal sources also have contributions. Potential impacts of NO_2 are above the Class II PSD increment at the maximum receptors in Wyoming.

The potential impacts of SO_2 emissions are well below the ambient standards and PSD increments for all scenarios. The potential impacts from power plants do, however, show substantial increases in impacts at the maximum power plant receptor. Those potential impacts are, however, still well below the ambient standards and PSD increments. These data are provided for comparison only and do not represent a regulatory PSD Increment Consumption Analysis.

Air Quality Impacts at Class I Area Receptors

As discussed in Chapter 2, the potential impacts at Class I areas were also modeled, with separate assessments for each Class I receptor group. The Class I area with the highest potential impacts was the Northern Cheyenne Indian Reservation in Montana. Those results are provided in Figure 3-3. The potential impacts are all well below the ambient standards, and also are less than the respective PSD increments.

Data for two other Class I areas are also presented (the Theodore Roosevelt National Park in Figure 3-4

and the Wind Cave National Park in Figure 3-5) as these two Class I areas represent the closest Class I areas east of the development area, and should provide a representative depiction of potential impacts at the Class I areas in western North Dakota and western South Dakota. For all areas, all potential impacts are well below the ambient standards, and are also well below the PSD increments for all pollutants modeled. It is also important to note that the comparative impacts for the ADY show little differentiation in potential impacts among the alternatives. The base year 24-hour PM_{10} impact at Theodore Roosevelt was 5.2 $\mu g/m^3$, and the impact at Wind Cave was 6.4 $\mu g/m^3$, against a Class I PSD increment of 8 $\mu g/m^3$. These data are provided for comparison only and do not represent a regulatory PSD Increment Consumption Analysis.

Air Quality Impacts at Sensitive Class II Area Receptors

Potential impacts at the Crow Indian Reservation are higher than potential impacts at the other identified Class II area receptor groups for all scenarios. Figure 3-6 provides a depiction of results similar to those provided above. For this receptor group, modeled impacts are all well below the ambient standards and they are below the established Class II PSD increments, except for potential impacts on the 24-hour PM_{10} levels. Again, there is little difference in impact among the proposed alternative development scenarios.

The other nearby Class II receptor group is the Cloud Peak Wilderness Area in north Central Wyoming, just west of the PRB. Results for this receptor group are shown in Figure 3-7. All potential impacts are well below applicable standards for all scenarios, and potential impacts are less than the Class II PSD increments for all scenarios. The 24-hour PM_{10} potential impacts reach 5 $\mu g/m^3$ for the base year, but this is less than the comparable PSD increment of 30 $\mu g/m^3$. The greatest percentage increases arise from coal and power plant operations, but these increases still do not exceed ambient standards or PSD increments. Data is also presented for the Bighorn Canyon National Recreation Area (Figure 3-8) and the Wind River Indian Reservation (Figure (3-9). For both of these Class II areas, potential impacts are well below applicable standards for all scenarios, and potential impacts are less than the Class II PSD increments for all scenarios. These data are provided for comparison only and do not represent a regulatory PSD Increment Consumption Analysis.

Impacts on Visibility

Under the Clean Air Act, visibility has been established as a critical resource for identified Class I areas. The study provides an analysis of potential impacts at the Class I areas and at sensitive Class II areas in the region. Under the guidance of the Federal Land Managers Air Quality Workgroup (FLAG), the potential impacts were provided using the CALPUFF modeling system and the Method 6 approach, which uses monthly relative humidity values for representative receptor groups.

Visibility potential impacts are based on the highest 24-hour calculated extinction at the indicated source receptors. Potential impacts are based on a presumed pristine background and calculated as a percent increase in extinction (reduced visibility) from that background value. The study tabulated the reduced visibility at the maximum impact receptor in each of the Class I and Class II groups in terms of the maximum reduction on any one 24-hour period, the number of days annually that showed visibility reductions of 5 percent and 10 percent. These reductions are indicated as reductions in deciviews (0.5 and 1 deciview respectively). A significance threshold of 10 percent has been used in this analysis to evaluate the impact from the source groups.

Table 3-2 provides a listing of potential visibility impacts for the base year for each of the analyzed areas with source contributions provided for all sources combined, all Montana sources, the listed CBM operation and construction potential impacts, and potential impacts from Montana oil and gas operations. More detailed data for contributions from other source groups are provided in Attachment A. For the Class I areas, the maximum potential impacts were determined at the North Cheyenne Indian Reservation, the Wind Cave National Park, and the Badlands National Park in South Dakota. Both of the South Dakota areas are downwind (prevailing wind direction from the west) from the PRB and the sources analyzed in this study. In the base year, model results showed more than 200 days of potential impacts with a change of 10 percent or more in extinction at each of these locations. All Class I areas showed some impact with no fewer than 21 days of impact greater than 1 deciview.

For the Class II areas, the maximum potential impacts were at the Crow Indian Reservation in Montana. Nine other Class II areas showed potential impacts of 1 deciview or more for 200 days or more per year, and these areas also were east (downwind in the prevailing wind direction) of the PRB. The results

showed that there was at least some impact on each of the receptor groups from each of the source groups. Coal operations dominated the potential impacts at the Class II areas, and the potential impacts on the Class I areas were noted for all the source groups.

The results also show that the Montana Oil and Gas operations and construction do not play a significant role in potential visibility impacts at either Class I or sensitive Class II areas. For the base year there are only a few days with visibility potential impacts above 5 deciviews at the Crow Indian Reservation and at the Northern Cheyenne Indian Reservation.

Table 3-3 provides a depiction of the potential impacts of all sources for each of the proposed alternatives. Data are provided for all receptor areas for all sources for each of the alternatives. For most areas, there is no change in impact among the alternatives. For example, at the areas with high potential impacts (Badlands and Theodore Roosevelt National Parks) there is no overall difference among the alternatives. At the Northern Cheyenne Indian Reservation, there is a change of 3 and 8 days respectively (for all sources combined) when comparing the potential impacts of Alternative E to Alternatives F and Alternative H respectively. At the Crow Indian Reservation, a maximum of 365 days per year are impacted for all scenarios. When examining the visibility potential impacts of all Montana sources for each alternative, there is only a change of one or two days of impact above 1.0 deciviews when comparing the potential impacts of these alternatives. The Northern Cheyenne Indian Reservation would see a slight increase in the number of days with potential impacts above 1.0 deciviews (from Alternative E through Alternative H), and the Crow Indian Reservation would continue to see 365 days/year impacted by a 1.0 deciview level. Other visibility impact data are provided in detail in Appendix A.

Impacts on Acid Deposition

Emissions of NO_X and SO_2 can lead to increasing potential impacts of acidic deposition in the region. This analysis evaluates the potential increase in acid deposition as a result of the increased production activity noted above. The base year analysis showed that potential impacts for all listed Class I and Class II areas were below the established thresholds for sulfur and nitrogen deposition, which are 5 kilograms per hectare per year (kg/ha-yr) for sulfur compounds and 3 kg/ha-yr for nitrogen compounds. Table 3-3 provides a summary of base year deposition levels at the sensitive receptor areas. The highest modeled impacts are at the Northern Cheyenne Indian Reservation with nitrogen deposition reaching 0.292 kg/ha-yr, or about 10 percent of the threshold. Maximum sulfur deposition is approximately 0.39 kg/ha-yr at the Northern Cheyenne Indian Reservation, or about 8 percent of the threshold. The table also shows that the contributions from base year CBM and Montana oil and gas operations and construction are minimal at any of the receptor areas.

Additional data are provided for other source groups in Appendix A. Relatively higher deposition rates were noted to the east of the PRB, as a result of the prevailing wind direction in the region. For all receptors and for both sulfur and nitrogen compounds, the combined deposition rates do not exceed the thresholds given in these tables.

For the ADY, potential impacts on acid deposition were calculated for each alternative. Table 3-4 provides a summary listing of potential impacts for each alternative, for all source groups combined. The results show that potential impacts are slightly higher than in the base year, but all potential impacts remain well below the deposition threshold. Potential impacts continue to be highest at the Northern Cheyenne Indian Reservation, with little difference among the alternatives. Total nitrogen potential impacts approach 2 kg/hectare-year, or about two-thirds of the threshold value. Sulfur deposition potential impacts also show little difference among the scenarios, and they approach approximately 10 percent of the threshold value.

Impacts on Sensitive Lake Acid Neutralizing Capacity

The analysis of potential impacts of deposition of acidic substances was carried out in accordance with the screening methodology as provided by the US Forest Service (USFS 2000). Data for lake neutralizing capacity were obtained from the USFS web site, which provides data for the 10 percent ANC values for the individual lakes that were evaluated. The threshold is intended to account for sensitive conditions that may occur with an episodic or seasonal basis. Input data to the analysis include the deposition rates that were modeled for the base year, and the development scenarios analyzed herein.

The input data are provided in Table 3-5 for the analyzed lakes. Results are provided for the base year analysis as well as the predicted development scenarios. The threshold for significance is based on

a 10 percent change in ANC for lakes with an ANC of 25 micro equivalents per liter (ueq/L) and a 1 ueq/L threshold change for lakes with an ANC value of less than 25 ueq/L.

Data on the modeled potential impacts for the lakes analyzed is provided in Table 3-6. All lakes except the Upper Frozen Lake in the Bridger WA have 10 percent ANC values of 25 ueq/L or more, and therefore Upper Frozen Lake is discussed separately below. For the other lakes the modeled percent ANC change is 10 percent or less at all lakes except Florence Lake. For that lake, the analyzed base year impact is 11.7 percent and the predicted impact for the ADY is 12.9 percent for all alternative development scenarios. There is no difference among the scenarios for potential impacts on these pristine lakes.

At Upper Frozen Lake, the base year impact was 2.4 ueq/L, which is more than the threshold value of 1 ueq/L threshold that is established for such lakes. The modeled results for each of the development scenarios show an impact of 2.6 ueq/L for Upper Frozen Lake, a change of only 0.2 ueq/L for that lake. The results show a minimal impact, and no difference in impact, among the alternatives considered for this evaluation.

Analysis of Hazardous Air Pollutant Impacts

The modeling study also addressed HAP potential impacts from sources in the study area. Since the potential impacts were greatest in the near-field receptor grids of both states, only those areas were analyzed for HAP potential impacts. The model was used to develop both 1-hour and annual potential impacts for these emissions. Results of the 1-hour modeled impacts for these modeling efforts were compared to the RELs (USEPA 2005). Table 3-6 provides an analysis of the short term potential impacts for the six analyzed compounds (benzene, ethyl benzene, formaldehyde, n-hexane, toluene, and xylene) compared to the RELs. Results show that all potential impacts are below the RELs except for formaldehyde in the Wyoming near-field receptor grid. Potential impacts are about 70 percent greater than the established REL for formaldehyde.

The potential impacts for chronic and carcinogenic risks are provided in Table 3-7 for the Montana and Wyoming near-field receptor grids. All potential impacts are well below the non-carcinogenic RfCs, with the maximum comparative impact for formaldehyde at the Wyoming near-field receptors, where those potential impacts are about 66 percent of the established RfC. The potential impacts for carcinogenic risk are also provided in Table 3-8. All potential impacts are well below the 1 in 1 million risk, except for benzene potential impacts in Wyoming, where the potential impacts are about 1.0 to 1.3×10^{-5} for the various scenarios. This impact is evident in the base year as well as each of the development scenarios.

Table 3-2
Visibility - Method 6 and Monthly f(RH) values - Base Year

Receptor Set	ALL SOURCES				ALL MT				MT CBM Construction				MT CBM Operation				MT OIL & GAS			
	Number of Days > N% Change in B_{ext}		Maximum % Change in B_{ext}	8th Highest % Change in B_{ext}	Number of Days > N% Change in B_{ext}		Maximum % Change in B_{ext}	8th Highest % Change in B_{ext}	Number of Days > N% Change in B_{ext}		Maximum % Change in B_{ext}	8th Highest % Change in B_{ext}	Number of Days > N% Change in B_{ext}		Maximum % Change in B_{ext}	8th Highest % Change in B_{ext}	Number of Days > N% Change in B_{ext}		Maximum % Change in B_{ext}	8th Highest % Change in B_{ext}
	5%	10%			5%	10%			5%	10%			5%	10%			5%	10%		
CLASS I AREAS																				
Badlands NP Class I	272	206	219	118	53	20	25	14	0	0	0.1	0.1	0	0	0.1	0.1	0	0	0.7	0.5
Bob Marshall W Class I	28	21	48	30	20	10	34	17	0	0	0.0	0.0	0	0	0.0	0.0	0	0	0.2	0.1
Bridger W Class I	230	152	437	156	38	19	40	18	0	0	0.2	0.0	0	0	0.2	0.1	0	0	0.9	0.2
Fitzpatrick W Class I	157	105	291	129	35	17	58	23	0	0	0.1	0.0	0	0	0.2	0.1	0	0	0.8	0.2
Fort Peck IR Class I	120	79	168	77	55	25	26	17	0	0	0.1	0.0	0	0	0.2	0.1	0	0	2.9	1.0
Gates of the Mountain W Class I	85	52	113	52	66	39	60	34	0	0	0.0	0.0	0	0	0.0	0.0	0	0	0.4	0.2
Grand Teton NP Class I	163	90	180	71	45	19	31	13	0	0	0.1	0.0	0	0	0.1	0.0	0	0	0.5	0.1
North Absaorka W Class I	149	85	229	110	90	41	66	37	0	0	0.2	0.0	0	0	0.3	0.1	0	0	1.1	0.5
North Cheyenne IR Class I	299	234	313	122	192	97	79	33	1	0	6.8	2.2	2	0	9.5	3.1	0	0	2.5	1.3
Red Rock Lakes Class I	96	48	87	49	49	20	41	16	0	0	0.0	0.0	0	0	0.1	0.0	0	0	0.4	0.1
Scapegoat W Class I	47	29	78	48	36	20	52	37	0	0	0.0	0.0	0	0	0.0	0.0	0	0	0.3	0.1
Teton W Class I	149	87	247	108	53	21	64	23	0	0	0.1	0.0	0	0	0.2	0.0	0	0	0.7	0.2
Theodore Roosevelt NP Class I	213	153	356	131	74	33	57	26	0	0	0.2	0.1	0	0	0.3	0.1	0	0	4.6	1.3
UL Bend W Class I	125	62	140	48	79	27	43	21	0	0	0.1	0.0	0	0	0.1	0.0	0	0	0.5	0.4
Washakie W Class I	169	110	335	144	75	38	85	43	0	0	0.2	0.0	0	0	0.3	0.1	0	0	1.1	0.4
Wind Cave NP Class I	320	247	265	147	69	22	24	16	0	0	0.2	0.1	0	0	0.2	0.1	0	0	2.0	0.8
Yellowstone NP Class I	188	102	207	91	102	45	64	30	0	0	0.2	0.0	0	0	0.2	0.0	0	0	1.1	0.2
SENSITIVE CLASS II AREAS																				
Absaorka Beartooth W Class II	201	131	266	109	170	100	135	45	0	0	0.4	0.1	0	0	0.6	0.1	0	0	2.1	0.5
Agate Fossil Beds NM Class II	295	225	401	130	54	14	21	14	0	0	0.1	0.1	0	0	0.2	0.1	0	0	1.0	0.3
Big Horn Canyon NRA Class II	356	295	376	154	200	122	143	63	0	0	1.2	0.6	0	0	1.9	0.9	10	2	24.6	5.8
Black Elk W Class II	306	214	252	144	67	23	22	15	0	0	0.1	0.1	0	0	0.2	0.1	0	0	2.3	0.6
Cloud Peak Class II	201	136	232	162	92	44	34	24	0	0	3.1	0.3	0	0	4.5	0.4	0	0	1.8	0.7
Crow IR Class II	365	360	428	266	365	350	401	165	1	0	5.2	2.6	5	0	7.2	3.4	14	2	18.1	6.7
Devils Tower NM Class II	324	260	268	130	82	29	29	17	0	0	0.2	0.1	0	0	0.3	0.2	0	0	2.2	0.9
Fort Belknap IR Class II	100	52	131	45	56	21	44	26	0	0	0.1	0.0	0	0	0.1	0.0	0	0	0.5	0.3
Fort Laramie NHS Class II	288	244	514	145	48	10	21	13	0	0	0.1	0.0	0	0	0.1	0.1	0	0	1.0	0.4
Jedediah Smith W Class II	167	94	172	59	45	22	31	14	0	0	0.0	0.0	0	0	0.1	0.0	0	0	0	0
Jewel Cave NM Class II	309	238	271	140	65	24	22	14	0	0	0.2	0.1	0	0	0.4	0.1	0	0	2	1
Lee Metcalf W Class II	165	107	138	55	140	87	89	40	0	0	0.1	0.0	0	0	0.1	0.0	0	0	1	0
Mt Naomi W Class II	78	51	195	70	4	1	12	3	0	0	0.0	0.0	0	0	0.1	0.0	0	0	0	0
Mt Rushmore Class II	297	202	248	140	61	23	22	15	0	0	0.1	0.1	0	0	0.2	0.1	0	0	2	1
Popo Agie W Class II	207	136	485	166	37	17	38	17	0	0	0.2	0.1	0	0	0.2	0.1	0	0	1	0
Soldier Creek WA Class II	297	240	396	119	59	18	20	15	0	0	0.1	0.1	0	0	0.2	0.1	0	0	1	0
Wellsville Mountain W Class II	62	36	157	54	1	0	8	2	0	0	0.0	0.0	0	0	0.1	0.0	0	0	0	0
Wind River IR Class II	305	235	546	224	97	44	88	39	0	0	3	2	1	0	5	1	0	0	1	0

Table 3-3
Visibility - Method 6 and Monthly f(RH) values - Future Alternatives

Receptor Set	ALL SOURCES - ALT E				ALL SOURCES - ALT F				ALL SOURCES - ALT H			
	Number of Days > N% Change in Bext		Maximum % Change in Bext	8th Highest % Change in Bext	Number of Days > N% Change in Bext		Maximum % Change in Bext	8th Highest % Change in Bext	Number of Days > N% Change in Bext		Maximum % Change in Bext	8th Highest % Change in Bext
	5%	10%			5%	10%			5%	10%		
CLASS I AREAS												
Badlands NP Class I	283	219	230	125	283	219	230	125	283	219	230	125
Bob Marshall W Class I	46	28	60	42	46	28	60	42	46	28	60	42
Bridger W Class I	225	146	456	152	225	146	456	152	225	147	456	152
Fitzpatrick W Class I	157	109	318	128	157	109	318	128	157	109	318	128
Fort Peck IR Class I	154	92	169	82	154	91	169	82	154	92	169	82
Gates of the Mountain W Class I	103	69	118	92	103	69	118	91	103	69	118	92
Grand Teton NP Class I	165	92	182	77	165	92	182	76	165	93	182	77
North Absaorka W Class I	161	90	256	129	161	90	255	129	161	90	256	129
North Cheyenne IR Class I	361	325	338	175	362	328	338	178	362	333	339	180
Red Rock Lakes Class I	99	50	94	53	99	50	94	53	99	50	94	53
Scapegoat W Class I	68	48	113	68	68	48	113	68	68	48	113	68
Teton W Class I	154	92	268	120	154	92	267	119	154	92	268	120
Theodore Roosevelt NP Class I	232	172	356	136	232	172	356	136	232	172	356	136
UL Bend W Class I	176	99	154	60	176	97	153	60	176	99	154	60
Washakie W Class I	178	115	368	152	177	115	368	152	178	115	369	152
Wind Cave NP Class I	325	262	275	147	325	262	275	147	325	262	276	147
Yellowstone NP Class I	193	105	226	97	193	105	225	97	193	105	226	97
SENSITIVE CLASS II AREAS												
Absaorka Beartooth W Class II	213	137	303	127	213	137	302	126	213	137	303	128
Agate Fossil Beds NM Class II	297	237	399	133	297	237	399	133	297	237	399	134
Big Horn Canyon NRA Class II	356	298	411	185	356	298	409	185	356	298	410	185
Black Elk W Class II	318	233	270	150	318	233	270	150	318	233	270	150
Cloud Peak Class II	216	147	239	177	216	146	239	176	216	147	239	177
Crow IR Class II	365	365	578	259	365	365	577	253	365	365	578	257
Devils Tower NM Class II	328	279	278	135	328	279	278	134	328	279	278	135
Fort Belknap IR Class II	173	92	143	54	172	92	143	54	173	92	143	54
Fort Laramie NHS Class II	296	249	537	151	296	249	537	150	296	249	537	151
Jedediah Smith W Class II	169	96	174	66	169	95	174	66	169	96	174	66
Jewel Cave NM Class II	320	252	293	142	320	252	293	142	320	252	293	142
Lee Metcalf W Class II	175	114	153	62	175	114	152	62	175	114	153	62
Mt Naomi W Class II	80	52	198	70	80	52	198	70	80	52	198	70
Mt Rushmore Class II	312	221	262	147	311	221	262	147	312	221	262	147
Popo Agie W Class II	211	137	502	164	211	137	502	164	211	138	502	165
Soldier Creek WA Class II	299	245	396	126	299	245	396	126	299	245	396	126
Wellsville Mountain W Class II	64	40	161	57	64	40	161	57	64	40	161	57
Wind River IR Class II	310	243	566	214	310	243	565	214	311	243	566	214

Table 3-3 (continued)
Visibility - Method 6 and Monthly f(RH) values - Future Alternatives

Receptor Set	MT CBM Construction - ALT E				MT CBM Construction - ALT F				MT CBM Construction - ALT H			
	Number of Days > N% Change in Bext		Maximum % Change in Bext	8th Highest % Change in Bext	Number of Days > N% Change in Bext		Maximum % Change in Bext	8th Highest % Change in Bext	Number of Days > N% Change in Bext		Maximum % Change in Bext	8th Highest % Change in Bext
	5%	10%			5%	10%			5%	10%		
CLASS I AREAS												
Badlands NP Class I	0	0	0.2	0.1	0	0	0.4	0.3	0	0	0.5	0.3
Bob Marshall W Class I	0	0	0.1	0.0	0	0	0.1	0.0	0	0	0.3	0.1
Bridger W Class I	0	0	0.3	0.1	0	0	0.5	0.2	0	0	0.6	0.3
Fitzpatrick W Class I	0	0	0.3	0.1	0	0	0.5	0.2	0	0	0.9	0.4
Fort Peck IR Class I	0	0	0.7	0.2	0	0	0.7	0.3	0	0	2.6	0.6
Gates of the Mountain W Class I	0	0	0.4	0.1	0	0	0.3	0.1	0	0	1.4	0.4
Grand Teton NP Class I	0	0	0.2	0.1	0	0	0.3	0.1	0	0	0.4	0.2
North Absaorka W Class I	0	0	0.5	0.3	0	0	1.1	0.4	0	0	1.3	0.8
North Cheyenne IR Class I	0	0	2.4	0.9	50	8	19.1	10.0	122	26	30.8	16.1
Red Rock Lakes Class I	0	0	0.3	0.1	0	0	0.3	0.1	0	0	1.1	0.2
Scapegoat W Class I	0	0	0.2	0.1	0	0	0.2	0.1	0	0	0.7	0.2
Teton W Class I	0	0	0.3	0.1	0	0	0.5	0.1	0	0	0.9	0.3
Theodore Roosevelt NP Class I	0	0	0.8	0.3	0	0	1.1	0.5	0	0	2.1	0.8
UL Bend W Class I	0	0	0.3	0.2	0	0	0.7	0.2	0	0	0.9	0.7
Washakie W Class I	0	0	0.7	0.3	0	0	0.7	0.4	0	0	1.5	0.7
Wind Cave NP Class I	0	0	0.3	0.1	0	0	0.6	0.3	0	0	0.6	0.3
Yellowstone NP Class I	0	0	0.4	0.2	0	0	0.9	0.2	0	0	1.6	0.6
SENSITIVE CLASS II AREAS												
Absaorka Beartooth W Class II	0	0	3.6	1.2	0	0	2.0	0.6	0	0	2.5	1.4
Agate Fossil Beds NM Class II	0	0	0.2	0.1	0	0	0.4	0.2	0	0	0.4	0.2
Big Horn Canyon NRA Class II	1	0	8.4	3.4	0	0	3.1	1.4	0	0	2.0	1.0
Black Elk W Class II	0	0	0.3	0.1	0	0	0.3	0.1	0	0	0.3	0.1
Cloud Peak Class II	0	0	1.3	0.4	0	0	2.5	0.6	0	0	2.2	0.5
Crow IR Class II	166	117	110.0	60.7	106	34	31.5	17.4	64	21	29.4	19.5
Devils Tower NM Class II	0	0	0.6	0.2	0	0	0.9	0.5	0	0	0.8	0.4
Fort Belknap IR Class II	0	0	0.3	0.1	0	0	0.6	0.2	0	0	1.0	0.5
Fort Laramie NHS Class II	0	0	0.2	0.1	0	0	0.4	0.2	0	0	0.4	0.2
Jedediah Smith W Class II	0	0	0.1	0.1	0	0	0.3	0.1	0	0	0.3	0.1
Jewel Cave NM Class II	0	0	0.3	0.1	0	0	0.6	0.3	0	0	0.5	0.3
Lee Metcalf W Class II	0	0	0.5	0.2	0	0	0.6	0.2	0	0	1.9	0.6
Mt Naomi W Class II	0	0	0.1	0.0	0	0	0.1	0.0	0	0	0.2	0.0
Mt Rushmore Class II	0	0	0.3	0.1	0	0	0.6	0.3	0	0	0.6	0.3
Popo Agie W Class II	0	0	0.3	0.2	0	0	0.5	0.2	0	0	0.6	0.3
Soldier Creek WA Class II	0	0	0.2	0.1	0	0	0.5	0.2	0	0	0.4	0.3
Wellsville Mountain W Class II	0	0	0.1	0.0	0	0	0.1	0.0	0	0	0.2	0.0
Wind River IR Class II	0	0	0.5	0.3	0	0	0.8	0.4	0	0	1.5	0.7

Table 3-3 (continued)
Visibility - Method 6 and Monthly f(RH) values - Future Alternatives

Receptor Set	MT CBM Operation - ALT E				MT CBM Operation - ALT F				MT CBM Operation - ALT H			
	Number of Days > N% Change in Bext		Maximum % Change in Bext	8th Highest % Change in Bext	Number of Days > N% Change in Bext		Maximum % Change in Bext	8th Highest % Change in Bext	Number of Days > N% Change in Bext		Maximum % Change in Bext	8th Highest % Change in Bext
	5%	10%			5%	10%			5%	10%		
CLASS I AREAS	**CLASS I AREAS**											
Badlands NP Class I	2	0	6.7	3.9	1	0	6.4	3.7	2	0	6.5	3.7
Bob Marshall W Class I	0	0	1.5	0.5	0	0	1.4	0.4	0	0	1.5	0.5
Bridger W Class I	2	0	8.3	2.7	2	0	7.8	2.4	2	0	8.2	2.6
Fitzpatrick W Class I	2	0	8.9	2.4	2	0	8.2	2.2	2	0	8.7	2.3
Fort Peck IR Class I	7	1	10.2	5.0	6	0	9.4	4.1	6	0	9.9	4.9
Gates of the Mountain W Class I	0	0	4.1	1.1	0	0	3.5	0.9	0	0	3.9	1.0
Grand Teton NP Class I	0	0	4.9	1.2	0	0	4.5	1.1	0	0	4.8	1.2
North Absaorka W Class I	8	3	14.9	5.7	8	3	14.1	5.1	8	3	14.5	5.5
North Cheyenne IR Class I	296	215	130.4	61.8	294	206	125.3	59.0	328	240	118.7	63.5
Red Rock Lakes Class I	0	0	4.1	0.9	0	0	3.9	0.8	0	0	4.1	0.8
Scapegoat W Class I	0	0	2.5	0.8	0	0	2.2	0.7	0	0	2.4	0.8
Teton W Class I	3	0	7.8	2.2	3	0	7.2	2.0	3	0	7.6	2.1
Theodore Roosevelt NP Class I	11	2	15.0	6.8	11	2	13.6	6.2	11	2	14.4	6.6
UL Bend W Class I	6	1	10.2	3.5	6	0	9.6	3.2	6	0	9.9	3.4
Washakie W Class I	10	3	12.0	5.8	8	3	11.1	5.4	9	3	11.7	5.5
Wind Cave NP Class I	8	0	8.4	5.0	6	0	7.8	4.5	7	0	8.3	4.8
Yellowstone NP Class I	5	1	13.2	2.5	3	1	12.3	2.2	4	1	12.9	2.3
SENSITIVE CLASS II AREAS												
Absaorka Beartooth W Class II	12	4	33.1	6.5	10	3	31.3	6.0	12	4	32.1	6.2
Agate Fossil Beds NM Class II	1	0	5.3	2.5	0	0	4.9	2.3	1	0	5.2	2.4
Big Horn Canyon NRA Class II	45	24	34.8	17.7	37	18	30.5	14.2	52	27	33.9	18.2
Black Elk W Class II	6	0	8.8	4.7	4	0	8.2	4.4	6	0	8.7	4.5
Cloud Peak Class II	22	9	71.1	10.9	21	8	68.4	10.2	21	9	70.2	10.6
Crow IR Class II	228	131	133.6	54.1	205	115	129.2	46.0	331	257	240.5	128.8
Devils Tower NM Class II	11	2	10.9	6.7	11	1	10.2	6.3	11	1	10.6	6.6
Fort Belknap IR Class II	3	0	8.5	2.9	3	0	7.9	2.5	3	0	8.2	2.9
Fort Laramie NHS Class II	3	0	5.8	2.7	1	0	5.5	2.4	2	0	5.7	2.6
Jedediah Smith W Class II	0	0	3.9	1.3	0	0	3.7	1.2	0	0	3.9	1.3
Jewel Cave NM Class II	6	0	9.4	4.0	6	0	8.7	3.6	6	0	9.2	3.9
Lee Metcalf W Class II	1	0	8.2	1.9	1	0	7.6	1.5	1	0	8.0	1.8
Mt Naomi W Class II	0	0	2.3	0.4	0	0	2.1	0.4	0	0	2.2	0.4
Mt Rushmore Class II	6	0	8.5	4.5	4	0	7.9	4.3	6	0	8.3	4.4
Popo Agie W Class II	4	0	9.1	3.3	3	0	8.5	3.0	4	0	9.0	3.2
Soldier Creek WA Class II	1	0	6.2	3.1	1	0	5.8	2.9	1	0	6.1	3.0
Wellsville Mountain W Class II	0	0	2.1	0.3	0	0	2.0	0.3	0	0	2.1	0.3
Wind River IR Class II	9	4	13.2	6.0	9	3	12.2	5.6	9	4	12.9	5.8

Table 3-4
Modeled Deposition for Nitrogen and Sulfur - Base Year

Note: Bold type indicate a modeled impact that is above the Comparative Deposition Value

Receptor Set	POLLUTANT	*Maximum Deposition (kg/ha - yr)*				
		ALL SOURCES	*MT CBM Construction*	*MT CBM Operation*	*MT Oil & Gas*	Threshold
CLASS I AREAS						
Badlands NP Class I Area	Nitrogen	1.13E-01	2.75E-05	4.49E-05	5.05E-04	3
	Sulfur	1.63E-01	5.03E-06	2.37E-06	1.30E-05	5
Bridger W Class I Area	Nitrogen	1.18E-02	1.57E-06	2.54E-06	4.20E-05	3
	Sulfur	1.96E-02	3.22E-07	1.53E-07	1.03E-06	5
Bob Marshall W Class I Area	Nitrogen	1.17E-01	7.53E-06	1.26E-05	4.67E-05	3
	Sulfur	2.09E-01	1.84E-06	8.70E-07	1.10E-06	5
Fitzpatrick W Class I Area	Nitrogen	1.29E-01	7.41E-06	1.23E-05	6.05E-05	3
	Sulfur	1.72E-01	1.58E-06	7.51E-07	1.37E-06	5
Fort Peck IR Class I Area	Nitrogen	7.10E-02	1.52E-05	2.49E-05	6.00E-03	3
	Sulfur	1.33E-01	2.36E-06	1.12E-06	2.31E-05	5
Gates of the Mountain W Class I Area	Nitrogen	6.70E-02	4.46E-06	7.22E-06	1.48E-04	3
	Sulfur	8.11E-02	7.96E-07	3.79E-07	2.69E-06	5
Grand Teton NP Class I Area	Nitrogen	6.36E-02	5.46E-06	8.94E-06	4.47E-05	3
	Sulfur	1.69E-01	8.99E-07	4.27E-07	9.17E-07	5
North Absaorka W Class I Are	Nitrogen	1.21E-01	1.51E-05	2.50E-05	3.31E-04	3
	Sulfur	1.97E-01	2.73E-06	1.28E-06	2.97E-06	5
North Cheyenne IR Class I Area	Nitrogen	2.92E-01	4.29E-03	7.15E-03	5.48E-03	3
	Sulfur	3.91E-01	3.76E-04	1.78E-04	2.92E-05	5
Red Rock Lakes Class I Area	Nitrogen	4.36E-02	2.76E-06	4.52E-06	3.59E-05	3
	Sulfur	6.13E-02	4.27E-07	2.03E-07	6.39E-07	5
Scapegoat W Class I Area	Nitrogen	2.76E-02	3.08E-06	4.95E-06	2.62E-04	3
	Sulfur	4.44E-02	5.69E-07	2.70E-07	2.23E-06	5
Teton W Class I Area	Nitrogen	7.98E-02	7.92E-06	1.31E-05	9.97E-05	3
	Sulfur	1.51E-01	1.51E-06	7.13E-07	1.51E-06	5
Theodore Roosevelt NP Class I Area	Nitrogen	2.50E-01	2.79E-05	4.60E-05	2.89E-03	3
	Sulfur	3.39E-01	4.42E-06	2.10E-06	5.01E-05	5
UL Bend W Class I Area	Nitrogen	6.46E-02	1.19E-05	1.92E-05	3.86E-04	3
	Sulfur	9.09E-02	2.10E-06	9.98E-07	6.00E-06	5
Washakie W Class I Area	Nitrogen	1.17E-01	1.12E-05	1.86E-05	2.19E-04	3
	Sulfur	2.18E-01	2.15E-06	1.01E-06	2.44E-06	5
Wind Cave NP Class I Area	Nitrogen	1.96E-01	3.71E-05	6.40E-05	5.21E-04	3
	Sulfur	3.21E-01	7.02E-06	3.33E-06	1.37E-05	5
Yellowstone NP Class I Area	Nitrogen	8.02E-02	1.39E-05	2.30E-05	1.26E-04	3
	Sulfur	1.28E-01	2.16E-06	1.01E-06	1.85E-06	5
CLASS I / CLASS II SENSITIVE LAKES						
Black Joe Lake, Bridger WA	Nitrogen	9.64E-02	7.41E-06	1.24E-05	4.44E-05	3
	Sulfur	1.90E-01	1.81E-06	8.59E-07	1.08E-06	5
Deep Lake, Bridger WA	Nitrogen	9.87E-02	7.25E-06	1.21E-05	4.32E-05	3
	Sulfur	1.91E-01	1.78E-06	8.42E-07	1.06E-06	5
Emerald Lake, Cloud Peak WA	Nitrogen	1.52E-01	1.45E-04	2.60E-04	4.33E-04	3
	Sulfur	2.08E-01	2.07E-05	9.82E-06	6.16E-06	5
Florence, Cloud Peak WA,	Nitrogen	1.58E-01	1.37E-04	2.52E-04	4.27E-04	3
	Sulfur	2.16E-01	2.10E-05	9.95E-06	6.39E-06	5
Hobbs Lake, Bridger WA	Nitrogen	8.95E-02	5.54E-06	9.13E-06	3.68E-05	3
	Sulfur	1.69E-01	1.23E-06	5.83E-07	9.59E-07	5
Lower Saddlebag, Popo Agie WA	Nitrogen	1.16E-01	8.05E-06	1.36E-05	4.48E-05	3
	Sulfur	2.21E-01	1.96E-06	9.27E-07	1.07E-06	5
Ross Lake, Cloud Peak WA	Nitrogen	8.88E-02	6.93E-06	1.14E-05	5.09E-05	3
	Sulfur	1.64E-01	1.40E-06	6.63E-07	1.19E-06	5
Upper Frozen Lake, Bridger WA	Nitrogen	1.04E-01	7.18E-06	1.20E-05	4.20E-05	3
	Sulfur	1.97E-01	1.76E-06	8.34E-07	1.03E-06	5

Table 3-5
Maximum Deposition for Alternate Development Scenarios

Receptor Set	POLLUTANT	*Maximum Deposition (kg/ha - yr)*			
		ALL SOURCES - Alternative E	*ALL SOURCES - Alternative F*	*ALL SOURCES - Alternative H*	*Threshold*
CLASS I AREAS					
Badlands NP Class I Area	Nitrogen	1.20E-01	1.20E-01	1.20E-01	3
	Sulfur	1.83E-01	1.83E-01	1.83E-01	5
Bridger W Class I Area	Nitrogen	1.79E-02	1.78E-02	1.79E-02	3
	Sulfur	2.70E-02	2.70E-02	2.70E-02	5
Bob Marshall W Class I Area	Nitrogen	1.14E-01	1.14E-01	1.14E-01	3
	Sulfur	2.38E-01	2.38E-01	2.38E-01	5
Fitzpatrick W Class I Area	Nitrogen	1.30E-01	1.30E-01	1.30E-01	3
	Sulfur	1.87E-01	1.87E-01	1.88E-01	5
Fort Peck IR Class I Area	Nitrogen	7.93E-02	7.90E-02	7.95E-02	3
	Sulfur	1.46E-01	1.46E-01	1.46E-01	5
Gates of the Mountain W Class I Area	Nitrogen	9.39E-02	9.37E-02	9.39E-02	3
	Sulfur	1.11E-01	1.11E-01	1.11E-01	5
Grand Teton NP Class I Area	Nitrogen	6.53E-02	6.53E-02	6.53E-02	3
	Sulfur	1.78E-01	1.78E-01	1.78E-01	5
North Absaorka W Class I Are	Nitrogen	1.30E-01	1.30E-01	1.30E-01	3
	Sulfur	2.13E-01	2.13E-01	2.13E-01	5
North Cheyenne IR Class I Area	Nitrogen	1.87E+00	1.97E+00	1.99E+00	3
	Sulfur	4.88E-01	4.89E-01	4.92E-01	5
Red Rock Lakes Class I Area	Nitrogen	4.55E-02	4.55E-02	4.56E-02	3
	Sulfur	6.52E-02	6.52E-02	6.52E-02	5
Scapegoat W Class I Area	Nitrogen	4.13E-02	4.12E-02	4.14E-02	3
	Sulfur	6.12E-02	6.12E-02	6.12E-02	5
Teton W Class I Area	Nitrogen	8.36E-02	8.34E-02	8.36E-02	3
	Sulfur	1.61E-01	1.61E-01	1.61E-01	5
Theodore Roosevelt NP Class I Area	Nitrogen	2.58E-01	2.58E-01	2.58E-01	3
	Sulfur	3.53E-01	3.53E-01	3.53E-01	5
UL Bend W Class I Area	Nitrogen	9.11E-02	9.07E-02	9.15E-02	3
	Sulfur	1.23E-01	1.23E-01	1.23E-01	5
Washakie W Class I Area	Nitrogen	1.25E-01	1.24E-01	1.25E-01	3
	Sulfur	2.37E-01	2.37E-01	2.38E-01	5
Wind Cave NP Class I Area	Nitrogen	2.07E-01	2.07E-01	2.07E-01	3
	Sulfur	3.58E-01	3.58E-01	3.58E-01	5
Yellowstone NP Class I Area	Nitrogen	8.58E-02	8.56E-02	8.58E-02	3
	Sulfur	1.36E-01	1.36E-01	1.36E-01	5
CLASS I / CLASS II SENSITIVE LAKES					
Black Joe Lake, Bridger WA	Nitrogen	9.63E-02	9.62E-02	9.63E-02	3
	Sulfur	2.15E-01	2.15E-01	2.15E-01	5
Deep Lake, Bridger WA	Nitrogen	9.81E-02	9.81E-02	9.82E-02	3
	Sulfur	2.16E-01	2.16E-01	2.16E-01	5
Emerald Lake, Cloud Peak WA	Nitrogen	1.65E-01	1.64E-01	1.65E-01	3
	Sulfur	2.34E-01	2.34E-01	2.34E-01	5
Florence, Cloud Peak WA,	Nitrogen	1.70E-01	1.69E-01	1.70E-01	3
	Sulfur	2.43E-01	2.43E-01	2.43E-01	5
Hobbs Lake, Bridger WA	Nitrogen	8.83E-02	8.82E-02	8.83E-02	3
	Sulfur	1.82E-01	1.82E-01	1.82E-01	5
Lower Saddlebag, Popo Agie WA	Nitrogen	1.15E-01	1.15E-01	1.15E-01	3
	Sulfur	2.55E-01	2.55E-01	2.55E-01	5
Ross Lake, Cloud Peak WA	Nitrogen	8.94E-02	8.94E-02	8.95E-02	3
	Sulfur	1.76E-01	1.76E-01	1.76E-01	5
Upper Frozen Lake, Bridger WA	Nitrogen	1.03E-01	1.03E-01	1.03E-01	3
	Sulfur	2.22E-01	2.22E-01	2.22E-01	5

Table 3-6
Modeled Impacts on Acid Sensitive Lakes -Alternate Development Scenarios

Wilderness Area / Lake	Background ANC (ueq/l)	Number of Samples	Watershed Area (ha)	Annual Precipitation (meter)	Base Year ANC(o) (eq)	Base Year %ANC change	Base Year Hdep ueq/l	Alternative E %ANC change	Alternative E Hdep ueq/l	Alternative F %ANC change	Alternative F Hdep ueq/l	Alternative H %ANC change	Alternative H Hdep ueq/l
Bridger													
Black Joe	67	43	890	0.97	397109	4.2	2.9	4.6	3.1	4.6	3.1	4.6	3.1
Deep	60	61	205	0.97	80864	4.8	2.9	5.2	3.2	5.2	3.2	5.2	3.2
Hobbs	70	68	293	0.76	101715	4.9	3.3	5.1	3.5	5.1	3.5	5.1	3.5
Upper Frozen	5	(NA)	64.8	1.22	1033	123.9	2.4	133.1	2.6	133.1	2.6	133.1	2.6
Cloud Peak													
Emerald	55.3	9	293	0.97	104776	6.7	3.7	7.4	4.1	7.4	4.1	7.4	4.1
Florence	32.7	10	417	0.97	88177	11.7	3.8	12.9	4.2	12.9	4.2	12.9	4.2
Fitzpatrick													
Ross	53.5	35	4455	0.97	1768834	4.2	2.6	4.4	2.7	4.4	2.7	4.4	2.7
Popo Agie													
Lower Saddlebag	55.5	34	155	0.97	55628	6.2	3.4	6.7	3.7	6.7	3.7	6.7	3.7

Table 3-7
Modeled Acute Concentrations of Hazardous Air Pollutants (HAPs)
All Production Scenarios - All Sources

Receptor Set	*Pollutant*	*Averaging Period*	*RANK*	*Base Year*	*ALT E Total Impact*	*ALT F Total Impact*	*ALT H Total Impact*	*REL (µg/m3)*
Near Field Receptors All Data in µg/m^3								
Montana Near Field Receptors	Benzene	1-hour	1ST HIGH	0.29	0.36	0.31	0.30	1,300
	Ethyl Benzene	1-hour	1ST HIGH	0.01	0.01	0.01	0.01	35,000
	Formaldehyde	1-hour	1ST HIGH	13.3	16.6	14.2	13.8	94
	n-Hexane	1-hour	1ST HIGH	4.44	207.00	207.00	207.00	39,000
	Toluene	1-hour	1ST HIGH	0.2	0.3	0.3	0.3	37,000
	Xylene	1-hour	1ST HIGH	0.1	0.1	0.1	0.1	22,000
Wyoming Near Field Receptors	Benzene	1-hour	1ST HIGH	1.9	1.0	1.0	1.0	1,300
	Ethyl Benzene	1-hour	1ST HIGH	0.1	0.04	0.0	0.0	35,000
	Formaldehyde	1-hour	1ST HIGH	86.2	46.5	46.5	46.5	94
	n-Hexane	1-hour	1ST HIGH	3.1	12.8	12.8	12.8	39,000
	Toluene	1-hour	1ST HIGH	1.0	0.5	0.5	0.5	37,000
	Xylene	1-hour	1ST HIGH	0.4	0.2	0.2	0.2	22,000

Table 3-8
Modeled Annual Concentrations of Hazardous Air Pollutants (HAPs) - All Production Scenarios
All Sources

Receptor Set	*Pollutant*	*Averaging Period**	*RANK*	*Base Year*	*ALT E Total Impact*	*ALT F Total Impact*	*ALT H Total Impact*	*Non-Carcinogenic RfCs*
Near Field Receptors - Non-Carcinogenic Impacts								**All Data in µg/m^3**
Montana Near Field Receptors	Benzene	Annual	1ST HIGH	0.0026	0.0031	0.0031	0.0032	30
	Ethyl Benzene	Annual	1ST HIGH	0.0001	0.0001	0.0001	0.0001	1,000
	Formaldehyde	Annual	1ST HIGH	0.1210	0.1400	0.1400	0.1400	9.8
	n-Hexane	Annual	1ST HIGH	0.1250	1.6000	1.6000	1.6000	200
	Toluene	Annual	1ST HIGH	0.0001	0.0034	0.0034	0.0034	400
	Xylene	Annual	1ST HIGH	0.0006	0.0006	0.0006	0.0006	100
Wyoming Near Field Receptors	Benzene	Annual	1ST HIGH	0.0093	0.0055	0.0055	0.0055	30
	Ethyl Benzene	Annual	1ST HIGH	0.0004	0.0003	0.0003	0.0003	1,000
	Formaldehyde	Annual	1ST HIGH	0.4270	0.2390	0.2390	0.2390	9.8
	n-Hexane	Annual	1ST HIGH	0.0562	0.0826	0.0826	0.0826	200
	Toluene	Annual	1ST HIGH	0.0049	0.0028	0.0028	0.0028	400
	Xylene	Annual	1ST HIGH	0.0020	0.0011	0.0011	0.0011	100

Near Field Receptors - Carcinogenic Risk Evaluation*				**Risk Evaluation X 10^{-6}**			
Montana	Benzene	Annual	1ST HIGH	0.015	0.017	0.017	0.017
	Formaldehyde	Annual	1ST HIGH	0.000	0.001	0.001	0.001
Wyoming	Benzene	Annual	1ST HIGH	0.052	0.030	0.030	0.030
	Formaldehyde	Annual	1ST HIGH	0.002	0.001	0.001	0.001

*Benzene Concentrations multiplied by risk factor: $7.8 \times 10^{-6} \times 0.71$)
*Formaldehyde Concentrations multiplied by risk factor: $5.5 \times 10^{-9} \times 0.71$)

Figure 3-1
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Montana Near-field Receptors

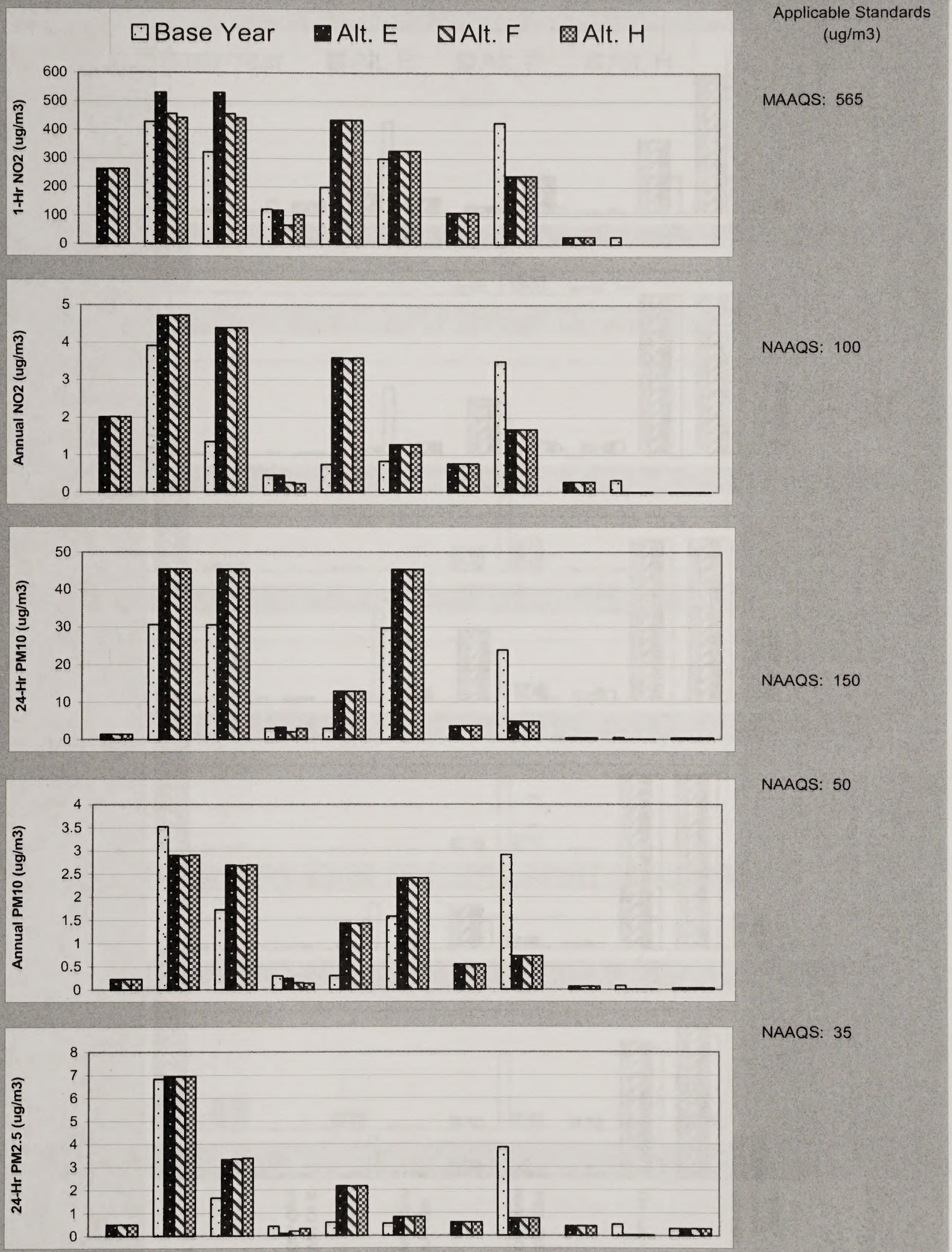


Figure 3-1 (continued)
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Montana Near-field Receptors

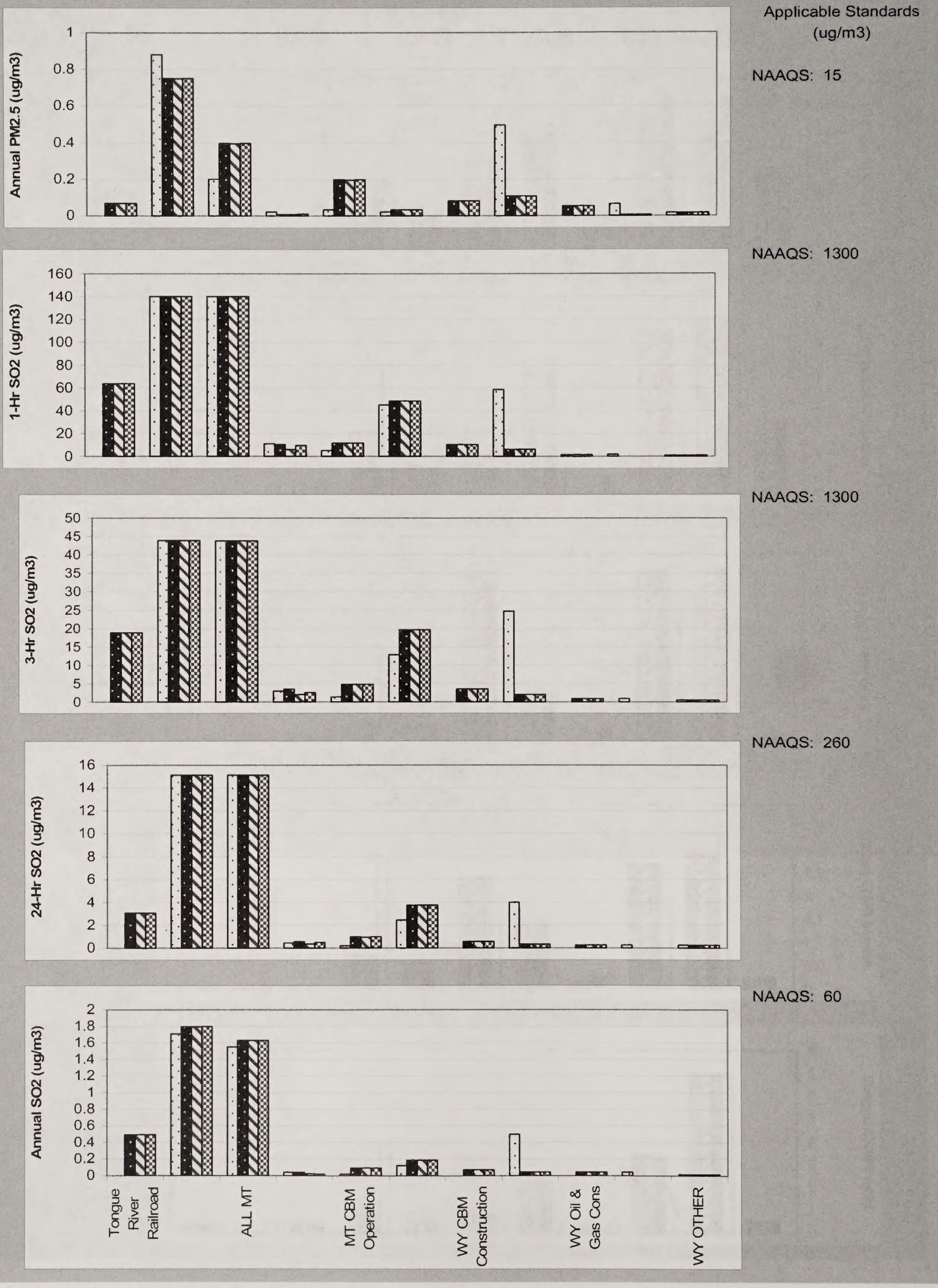


Figure 3-2
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Wyoming Near-field Receptors

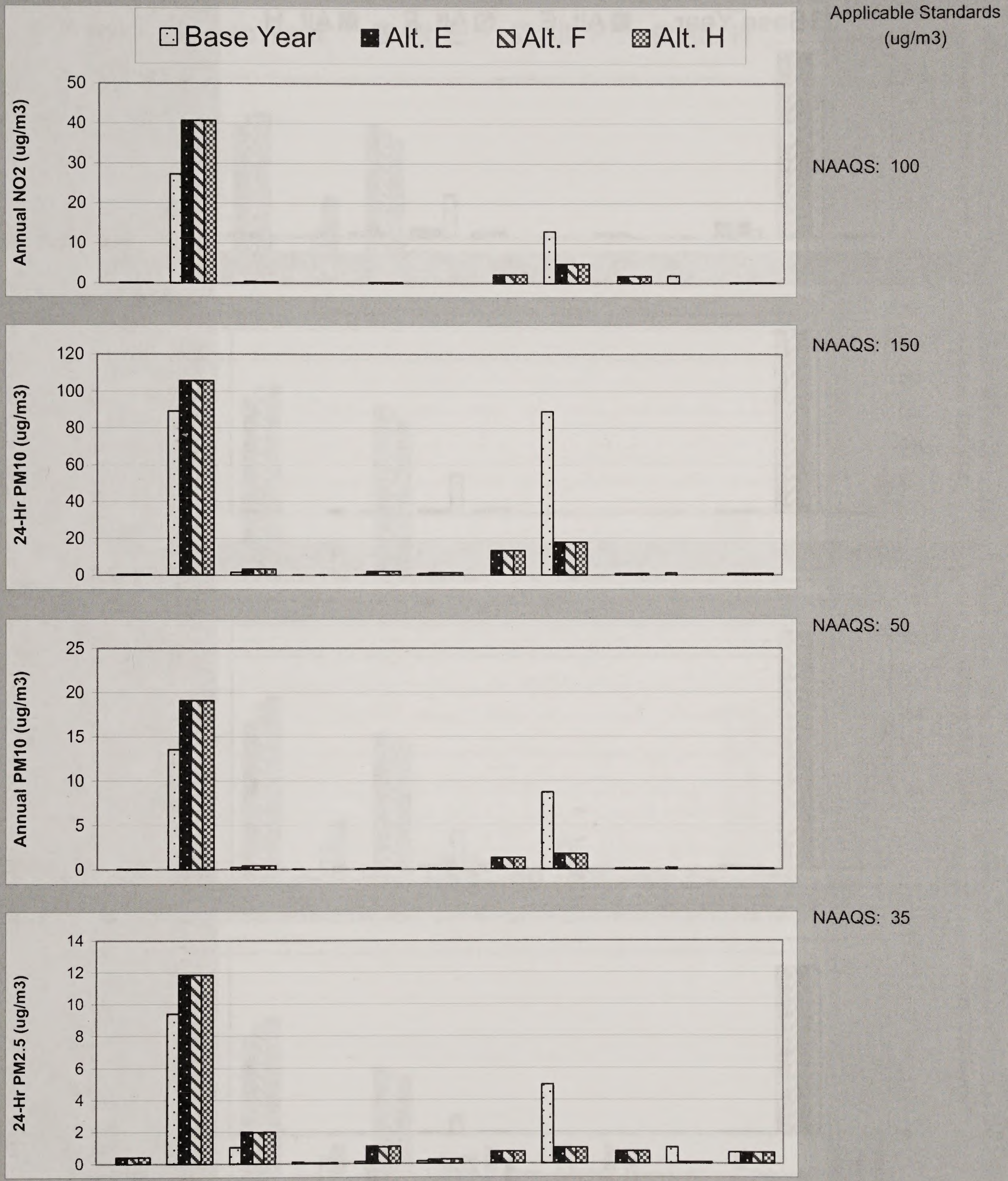


Figure 3-2 (continued)
Change in Modeled Concentrations of NO2, SO2, PM10, PM2.5
Wyoming Near-field Receptors

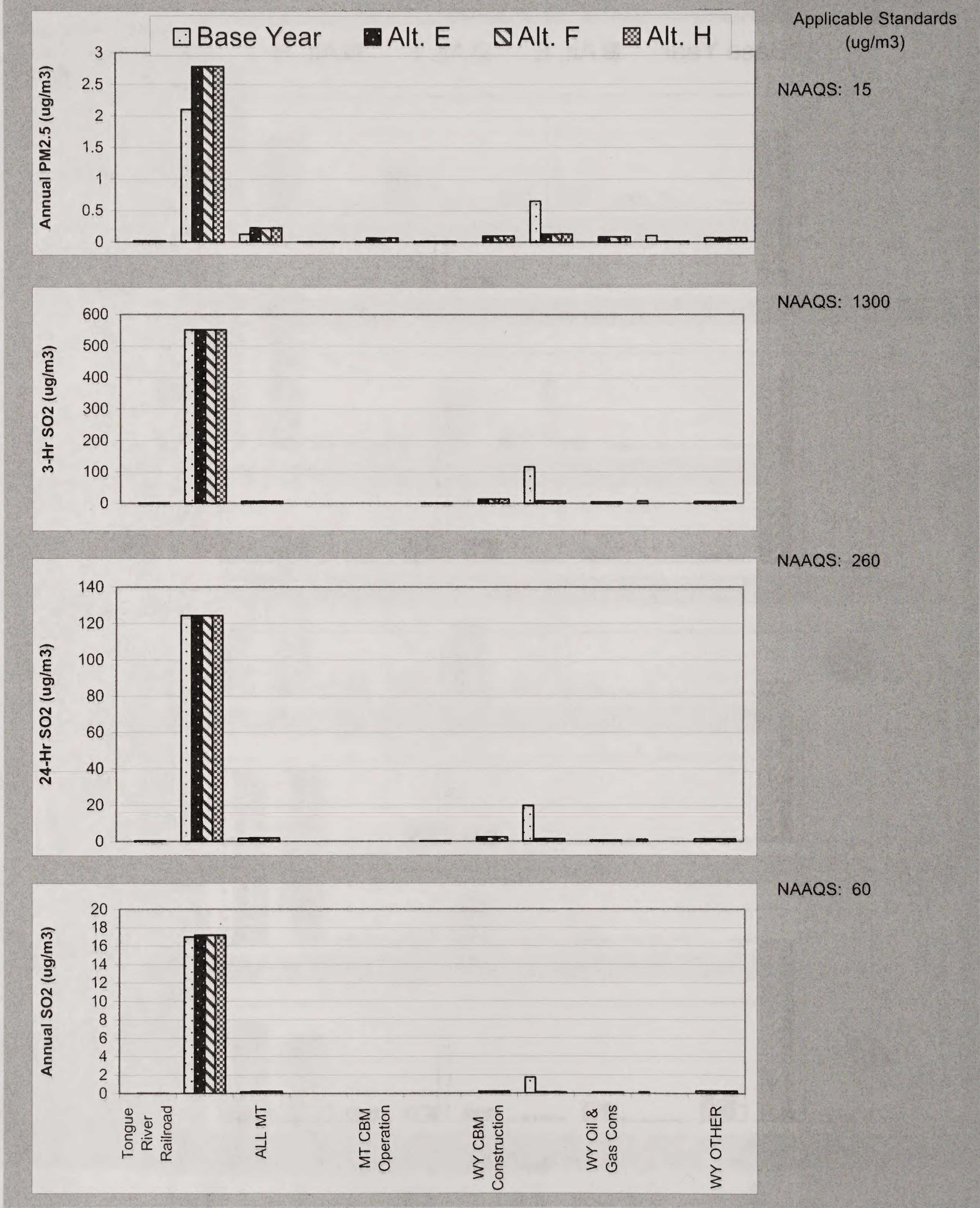


Figure 3-3
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Northern Cheyenne Indian Reservation

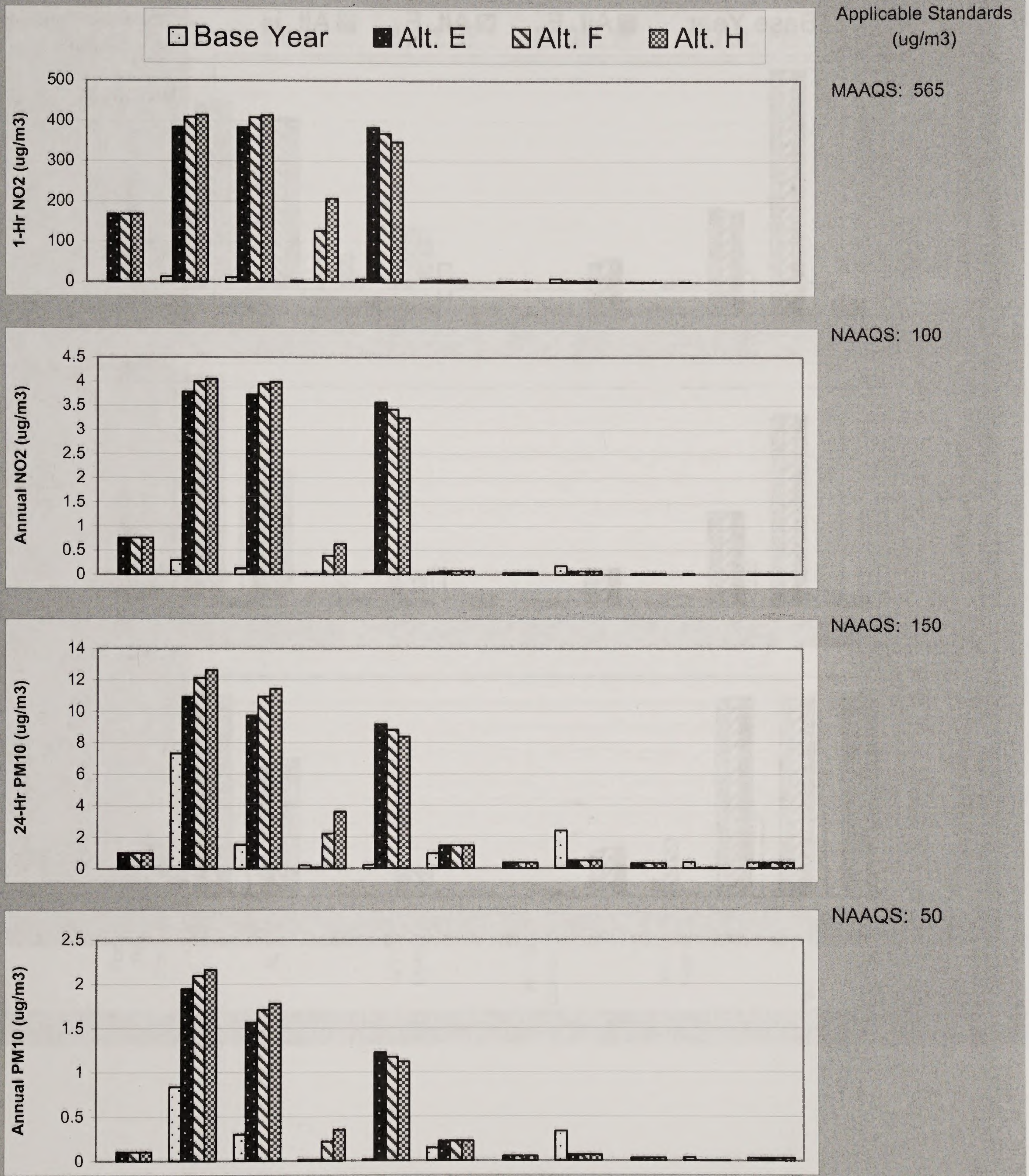


Figure 3-3 (continued)
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Northern Cheyenne Indian Reservation

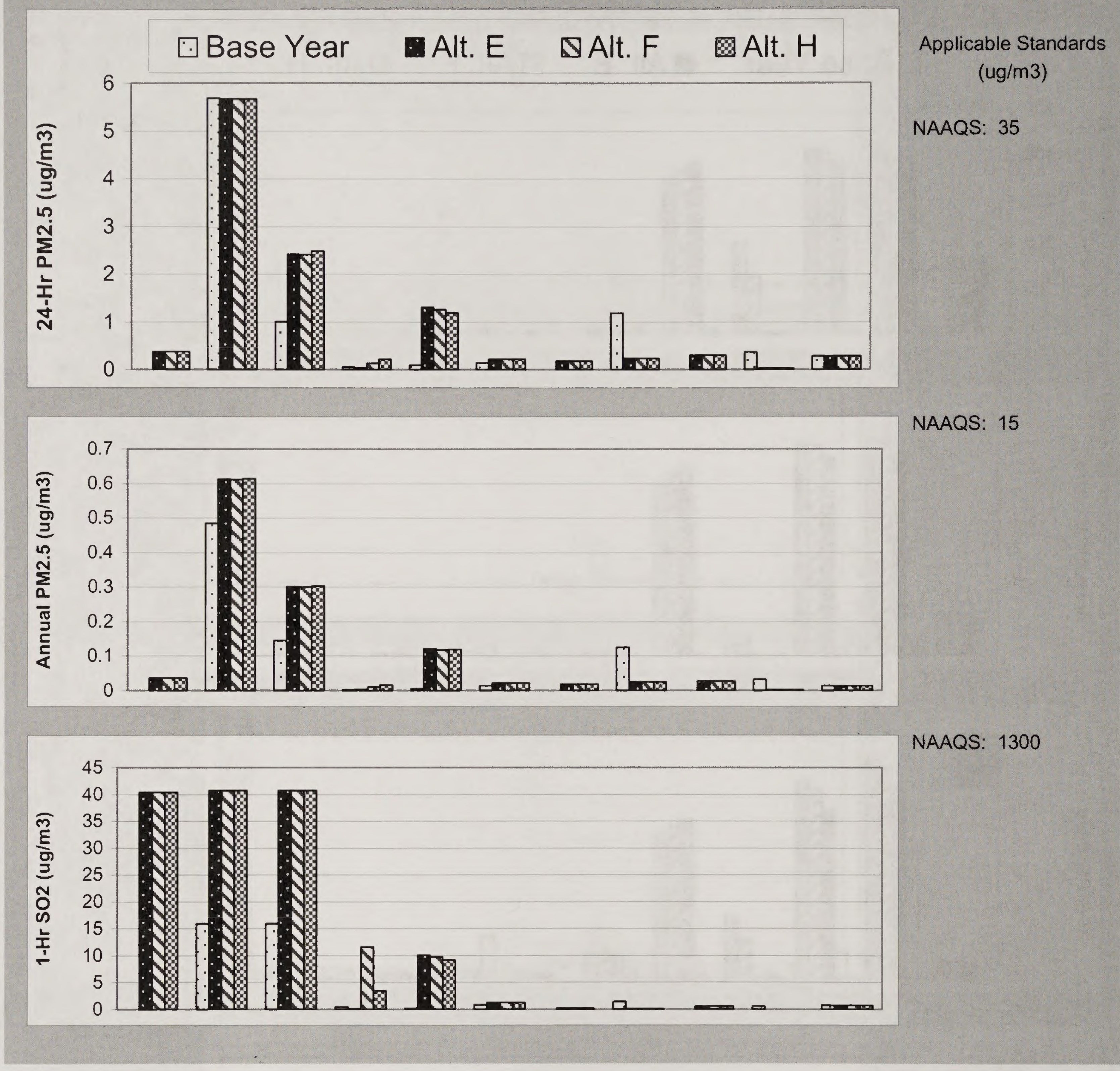


Figure 3-3 (continued)
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Northern Cheyenne Indian Reservation

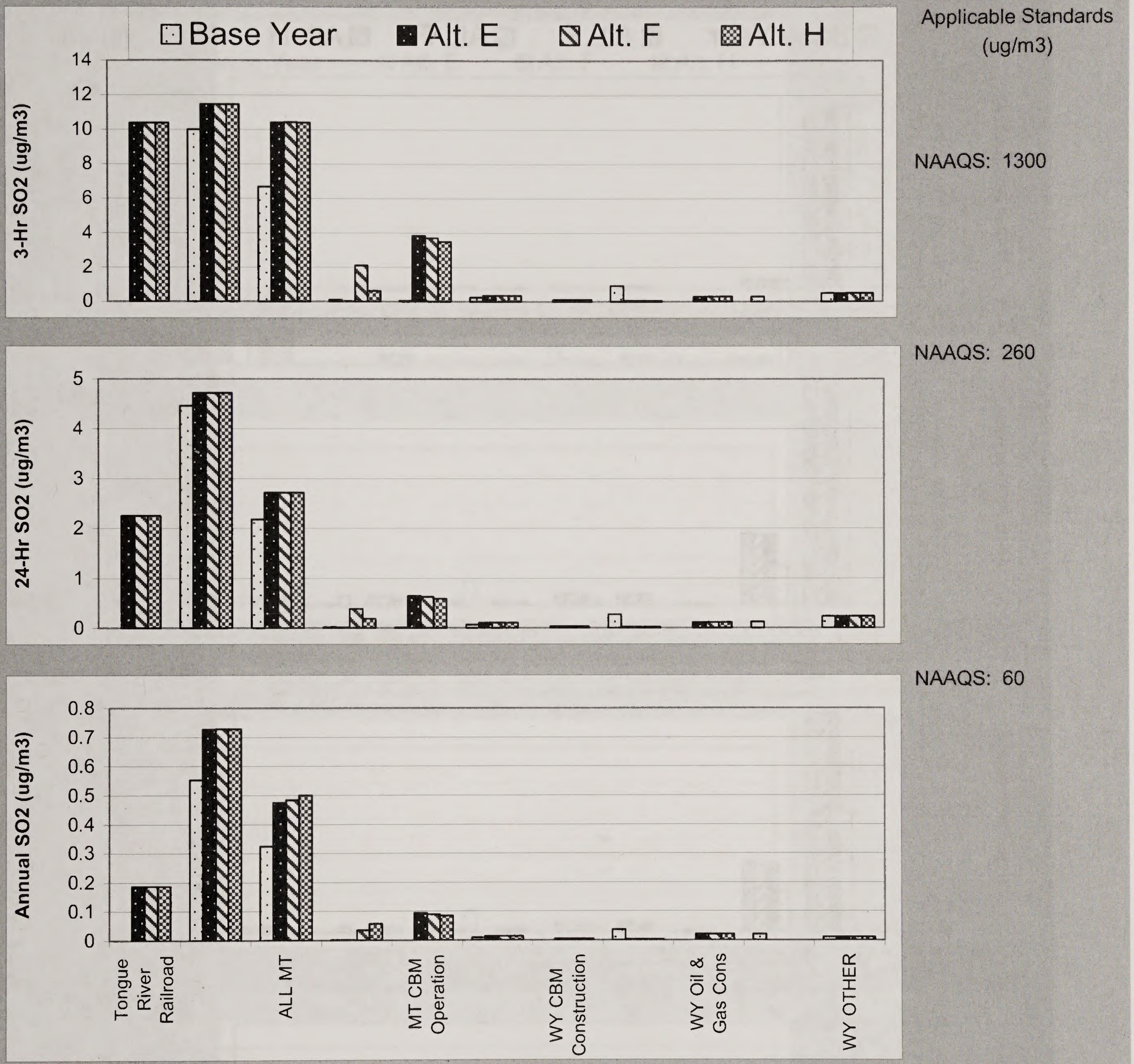


Figure 3-4
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Theodore Roosevelt National Park

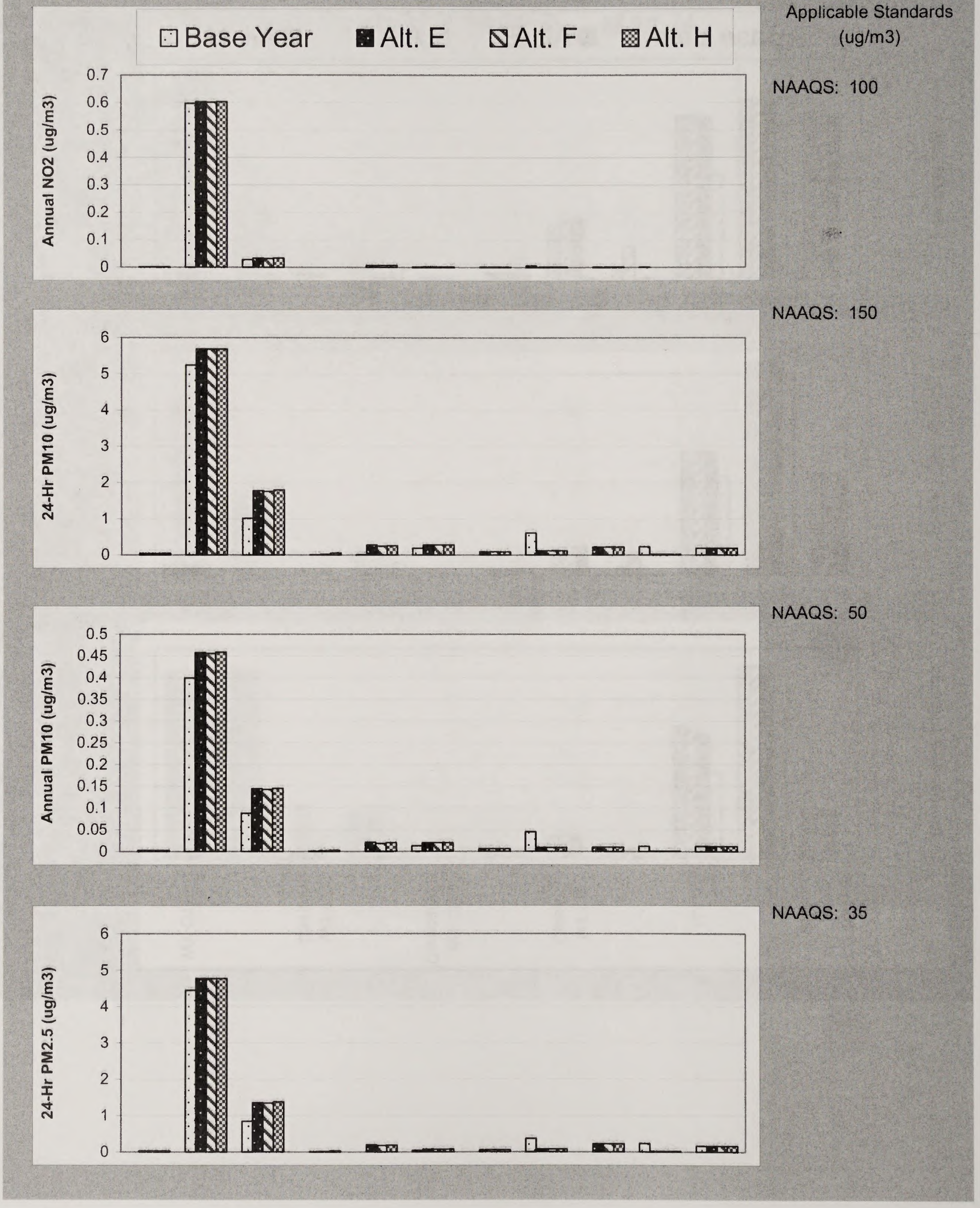


Figure 3-4 (continued)
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Theodore Roosevelt National Park

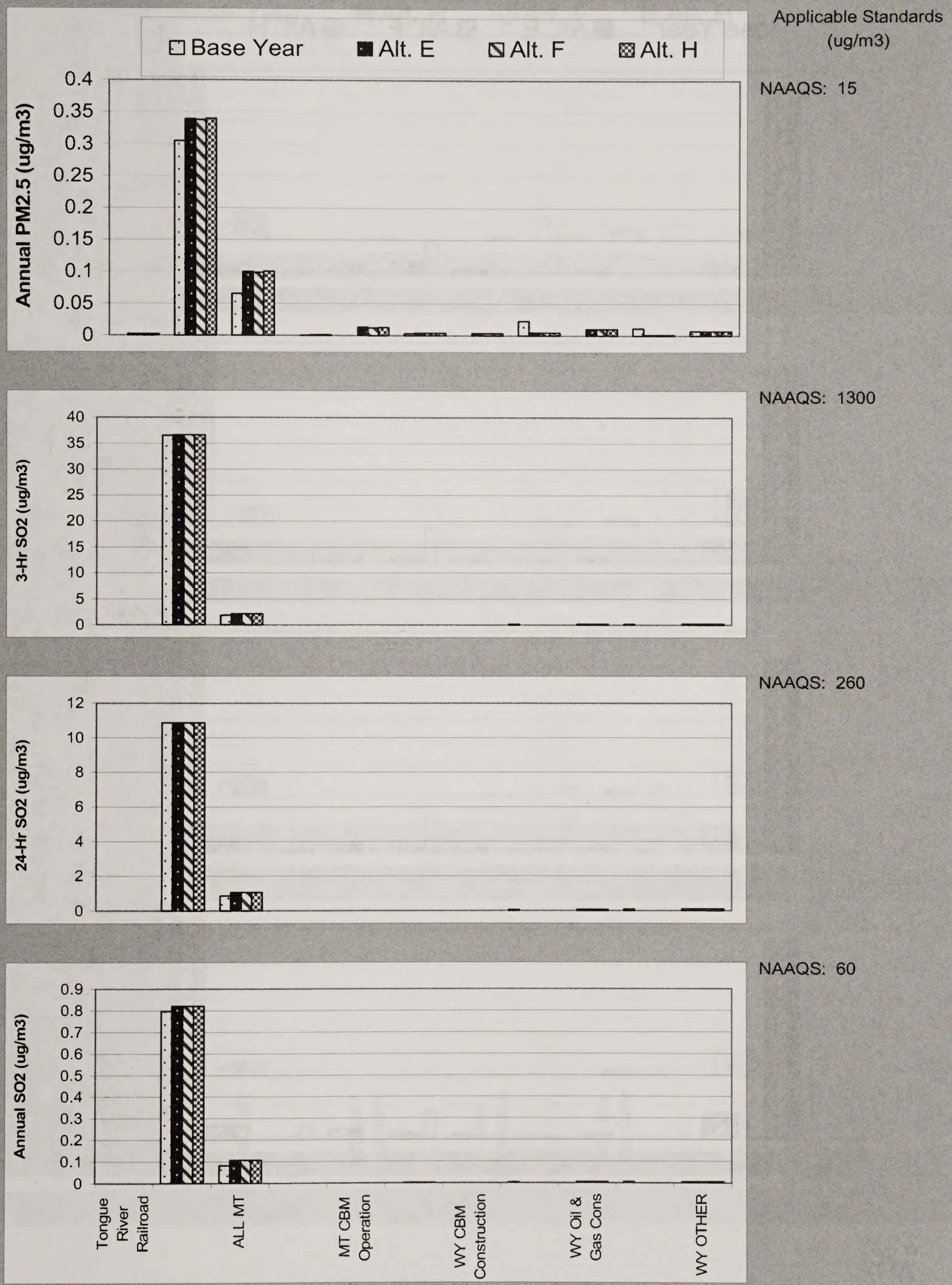


Figure 3-5
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Wind Cave National Park

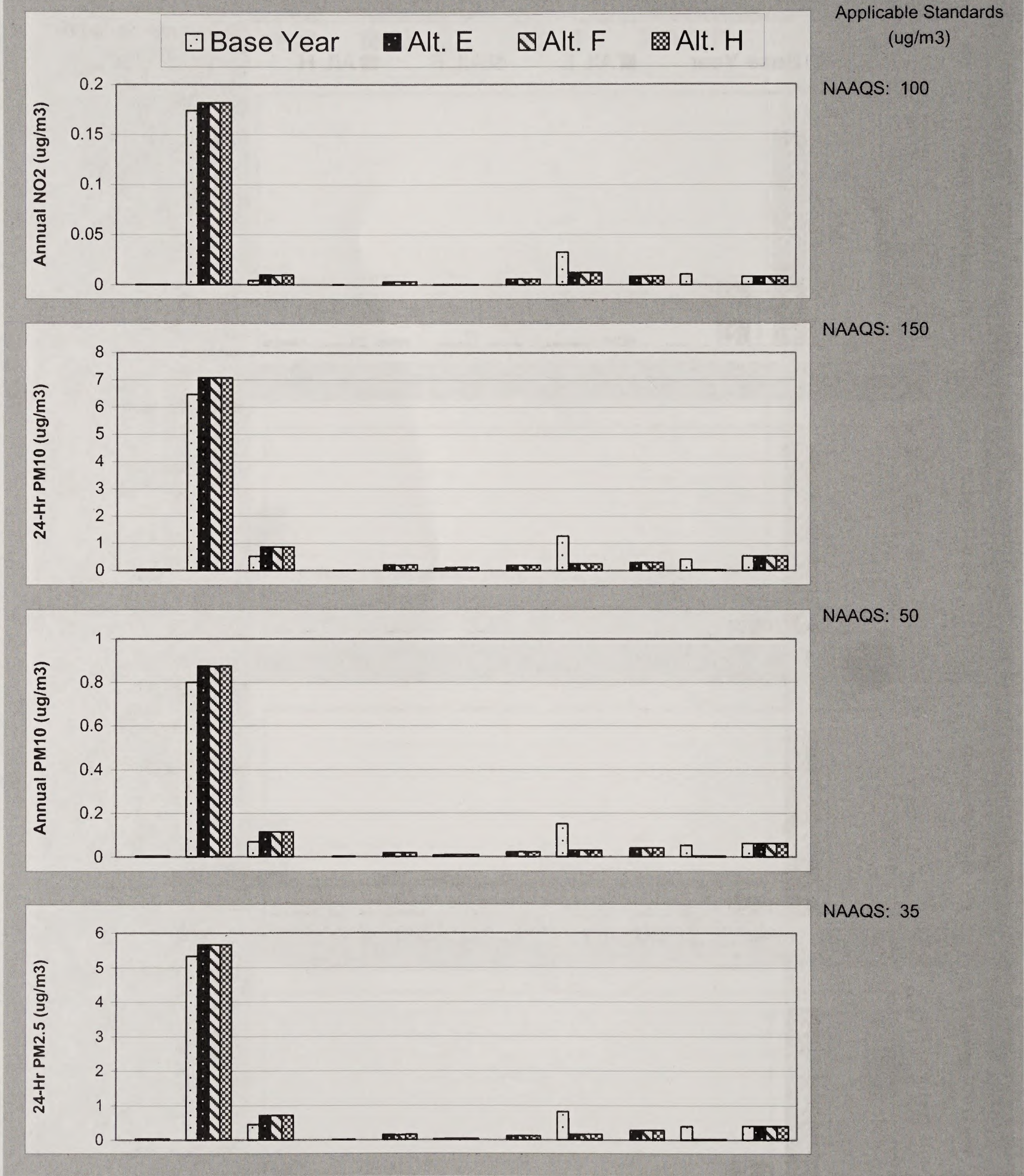


Figure 3-5 (continued)
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Wind Cave National Park

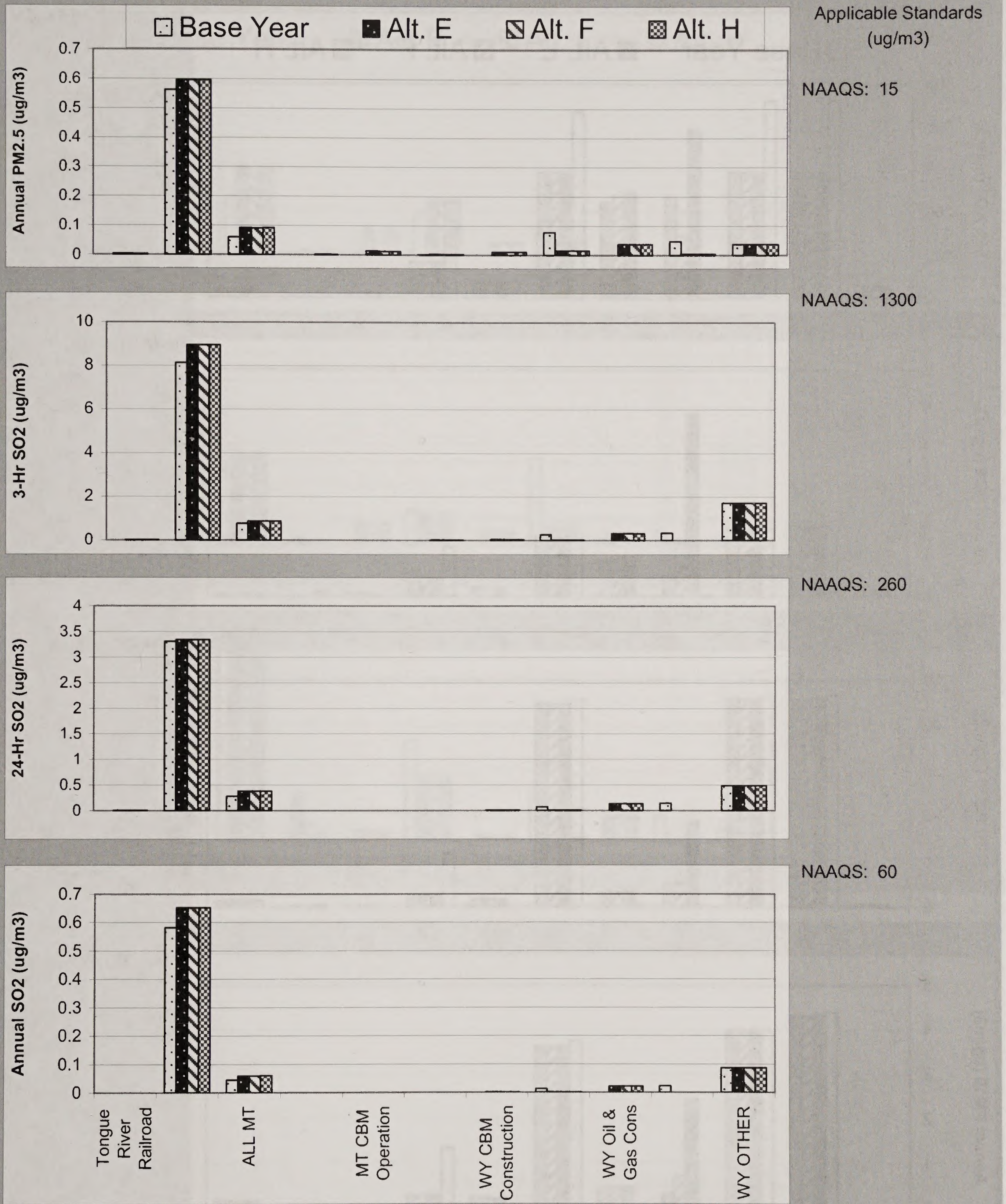


Figure 3-6
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Crow Indian Reservation

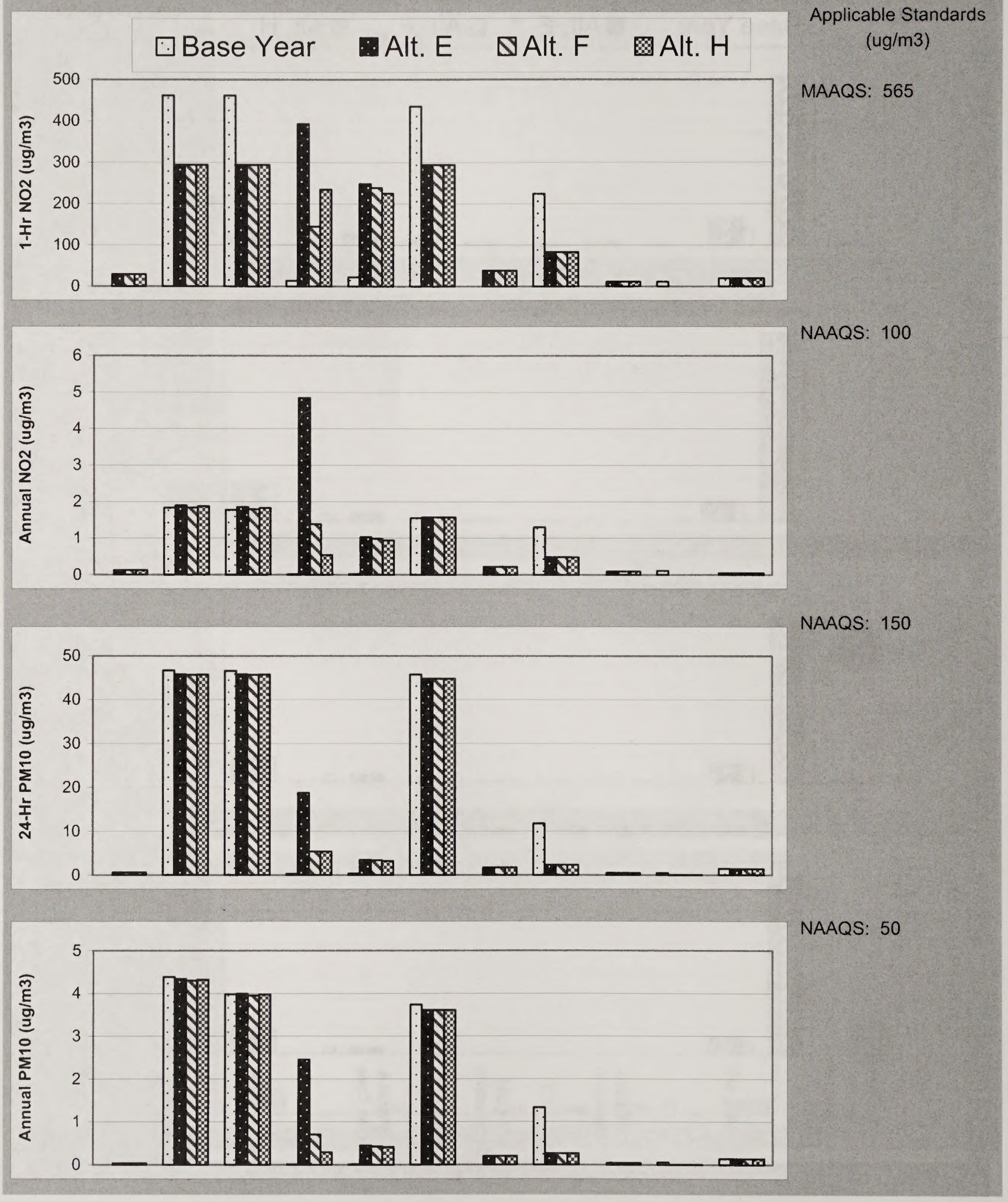
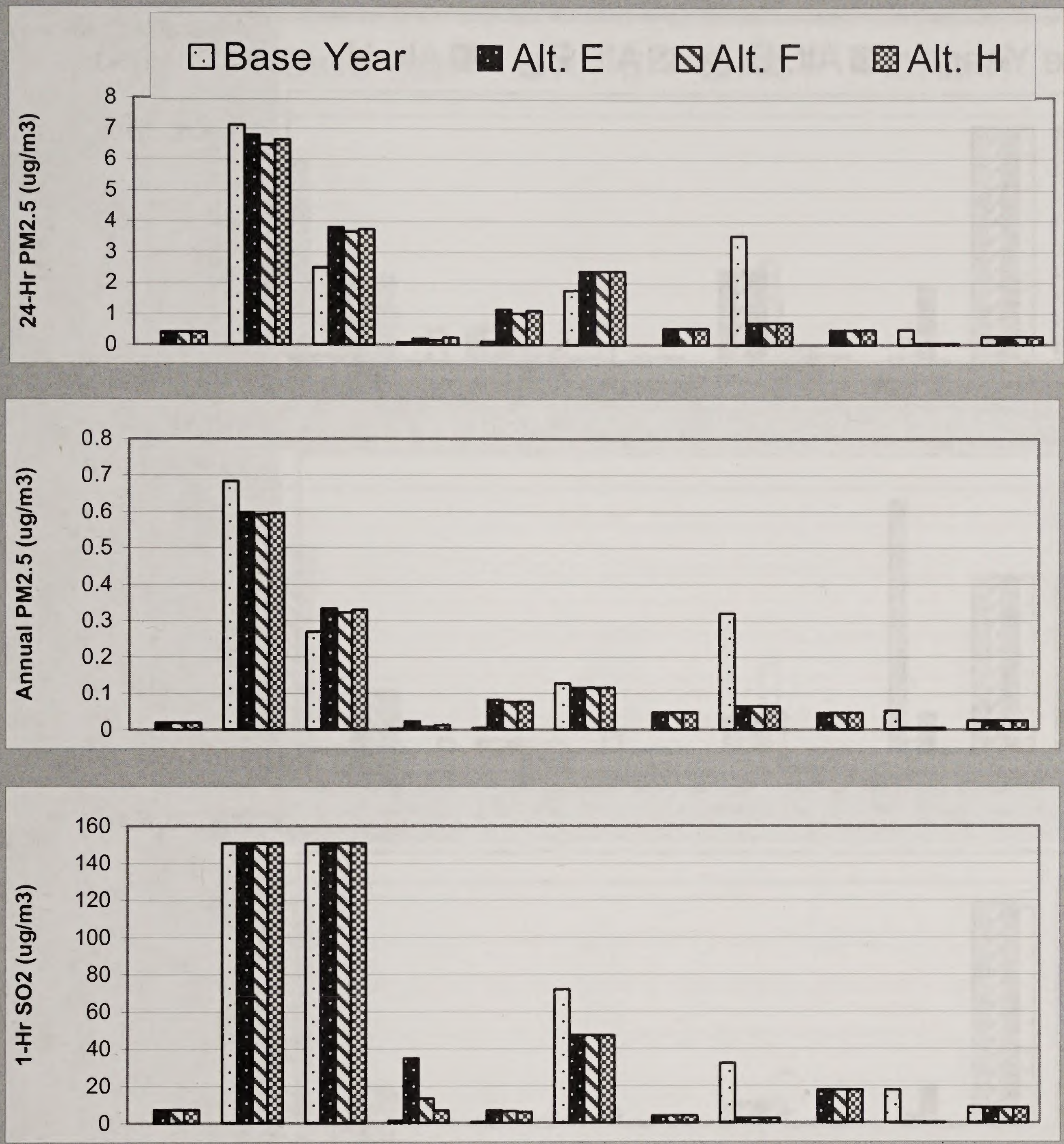


Figure 3-6 (continued)
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Crow Indian Reservation



Applicable Standards (ug/m3)

NAAQS: 35

NAAQS: 15

NAAQS: 1300

Figure 3-6 (continued)
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Crow Indian Reservation

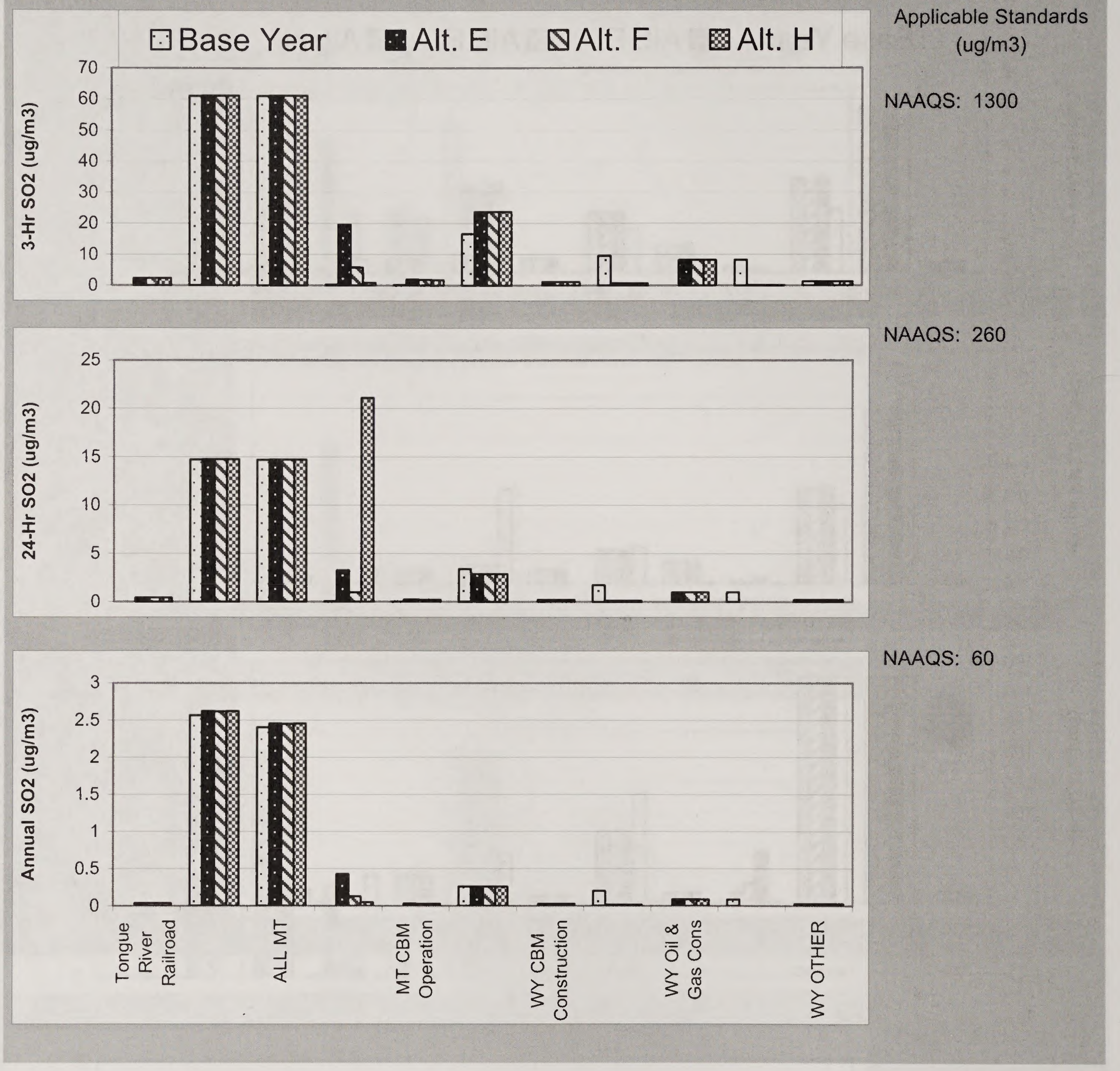
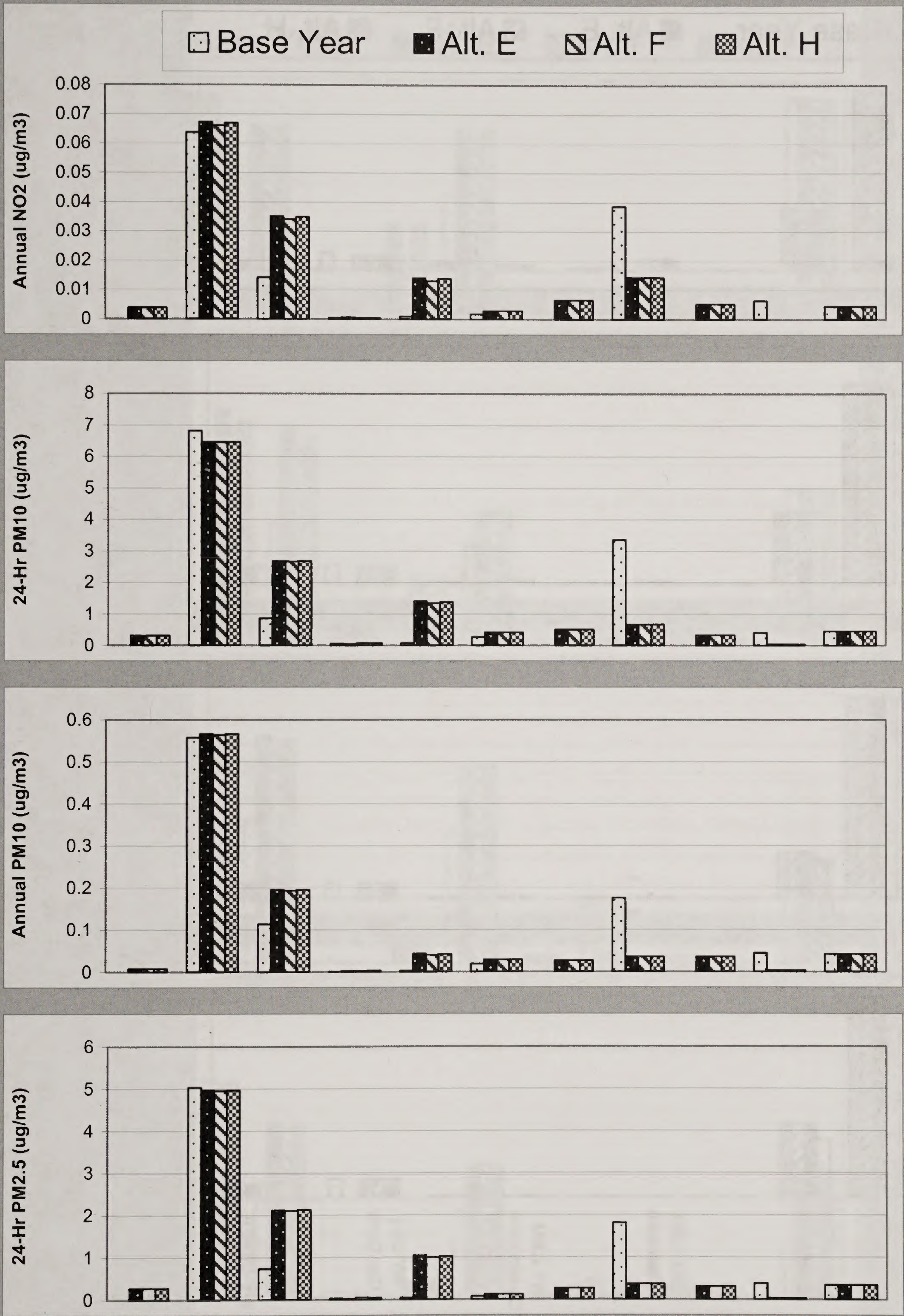


Figure 3-7
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Cloud Peak Wilderness



Applicable Standards (ug/m3)

NAAQS: 100

NAAQS: 150

NAAQS: 50

NAAQS: 35

Figure 3-7 (continued)
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Cloud Peak Wilderness

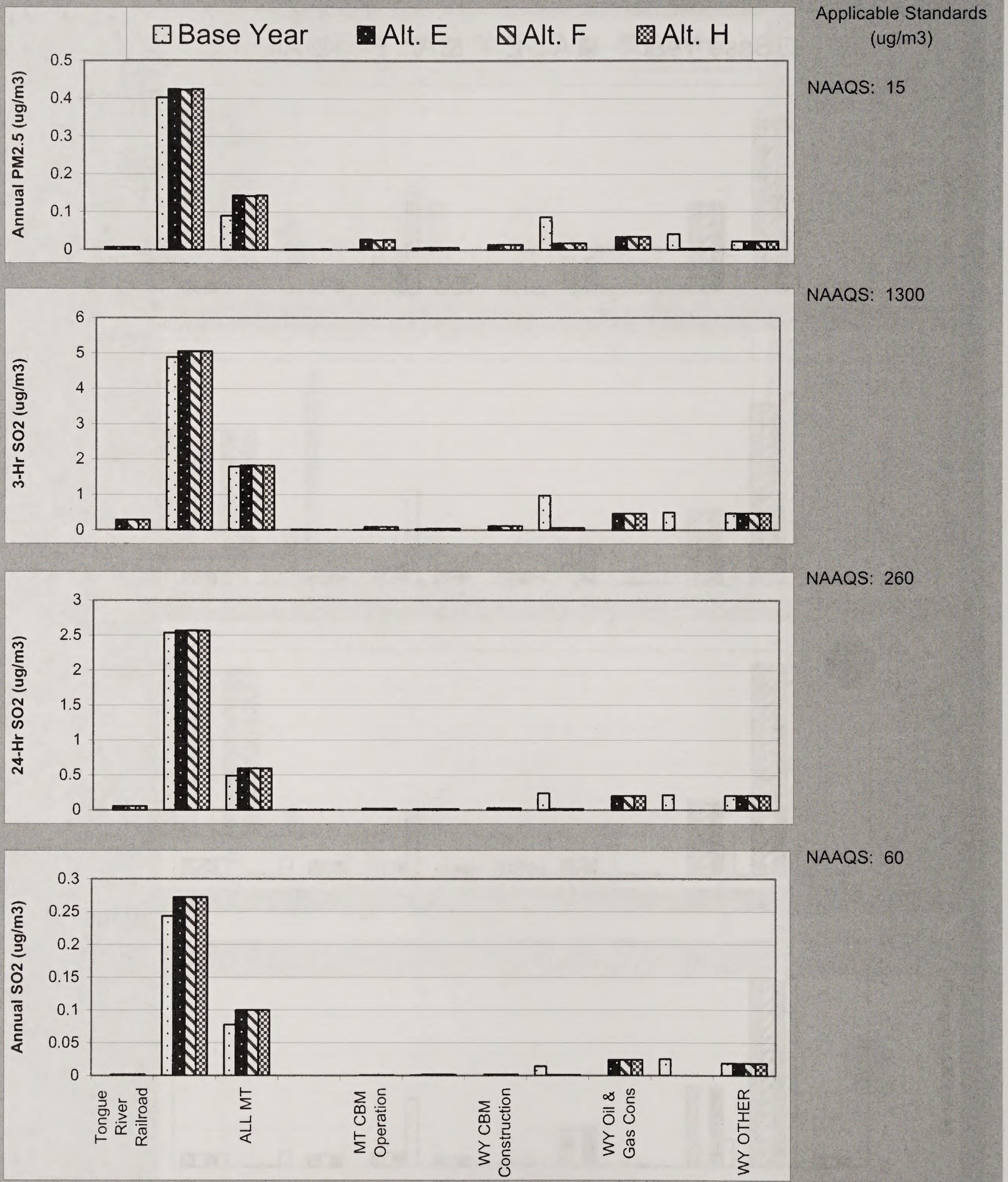


Figure 3-8
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Bighorn Canyon NRA

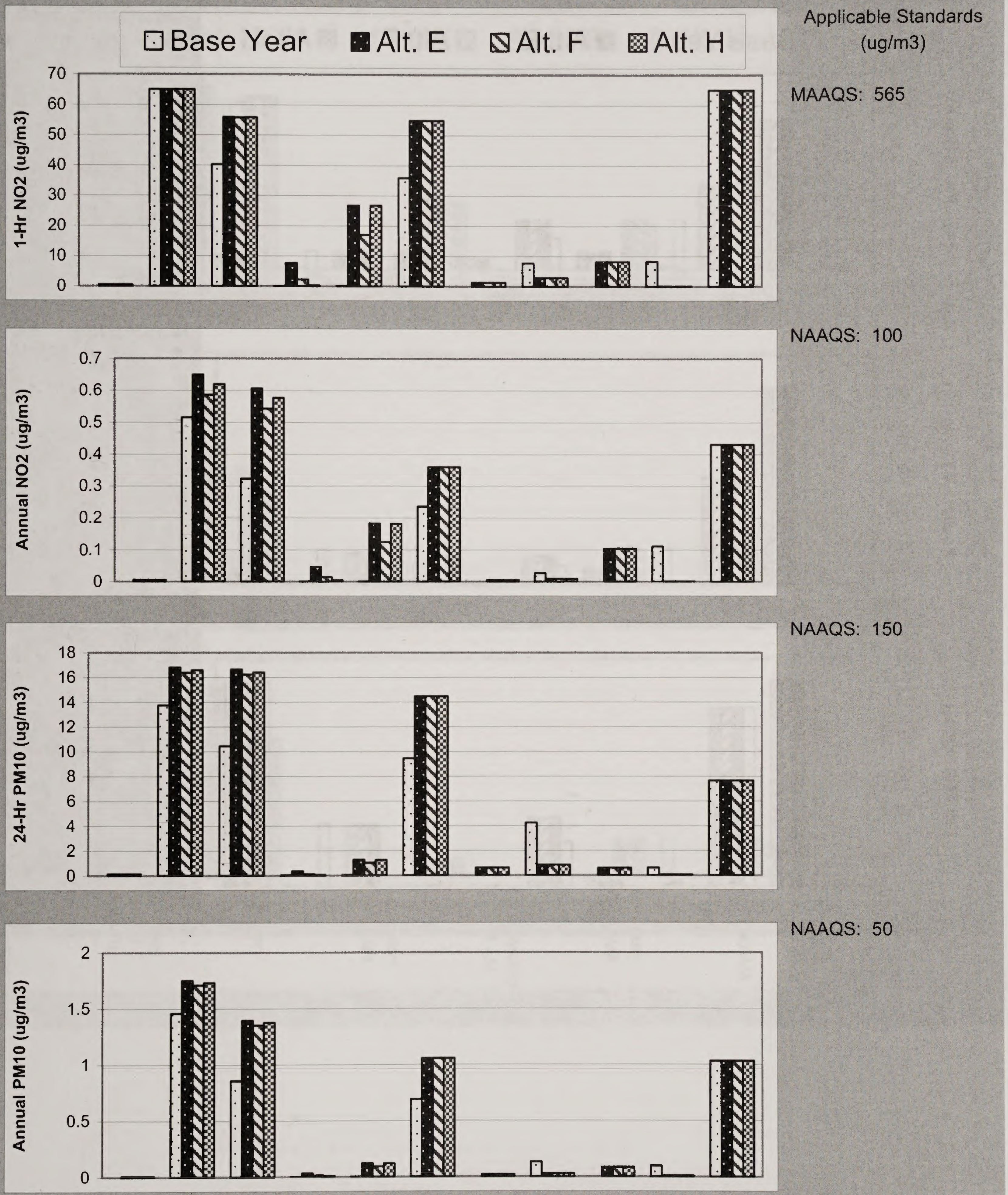


Figure 3-8 (continued)
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Bighorn Canyon NRA

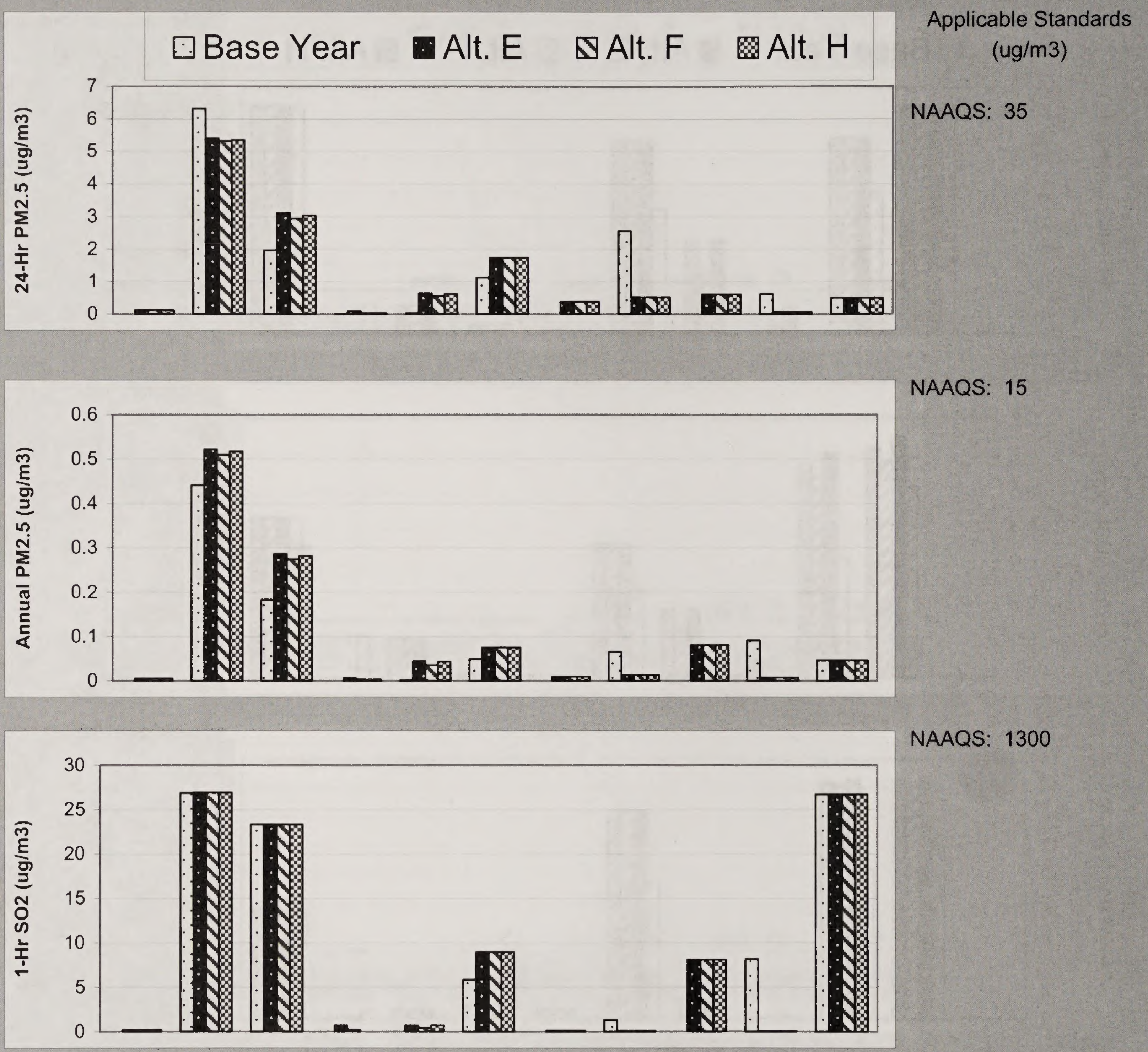
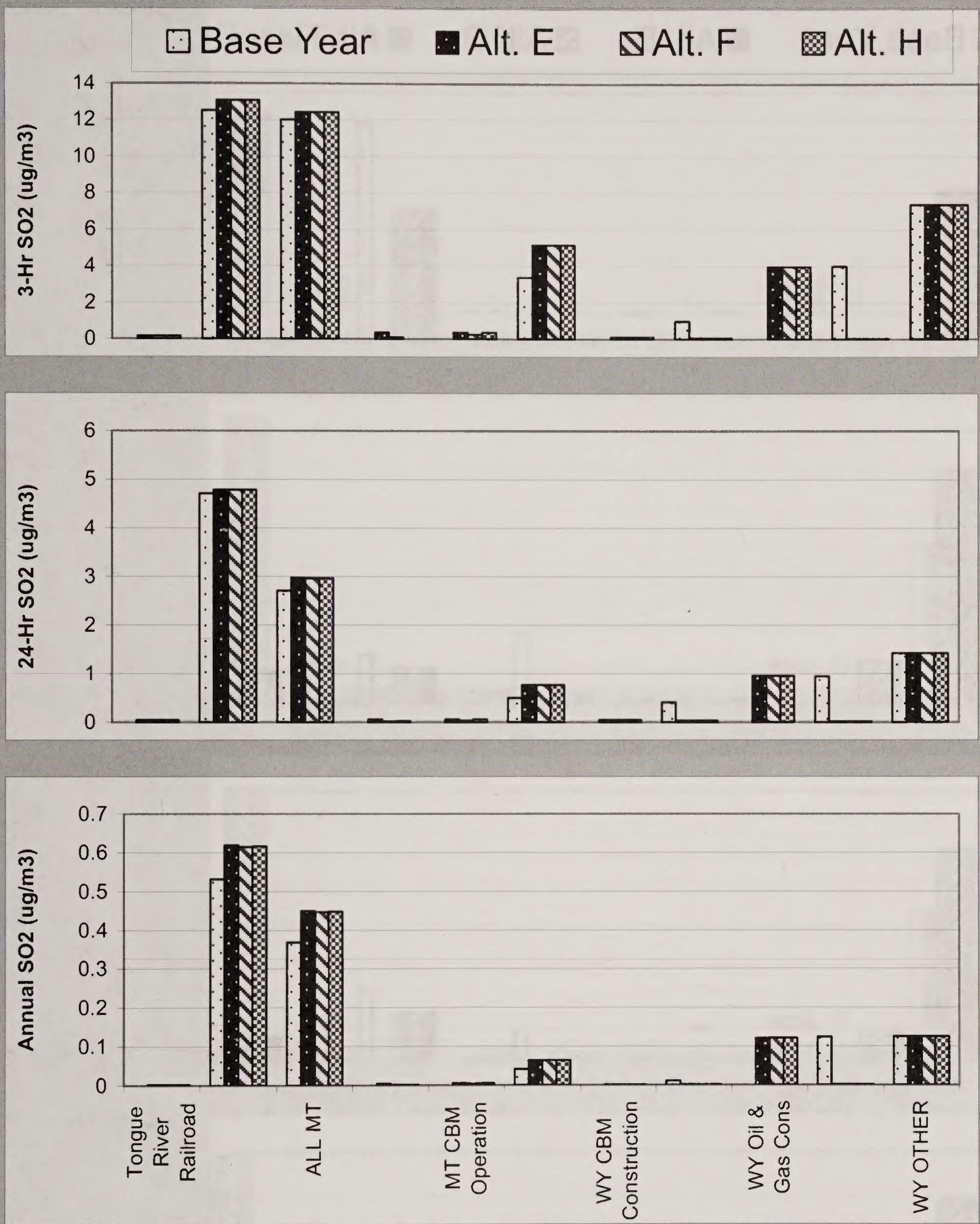


Figure 3-8 (continued)
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Bighorn Canyon NRA



Applicable Standards (ug/m3)

NAAQS: 1300

NAAQS: 260

NAAQS: 60

Figure 3-9
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Wind River Indian Reservation

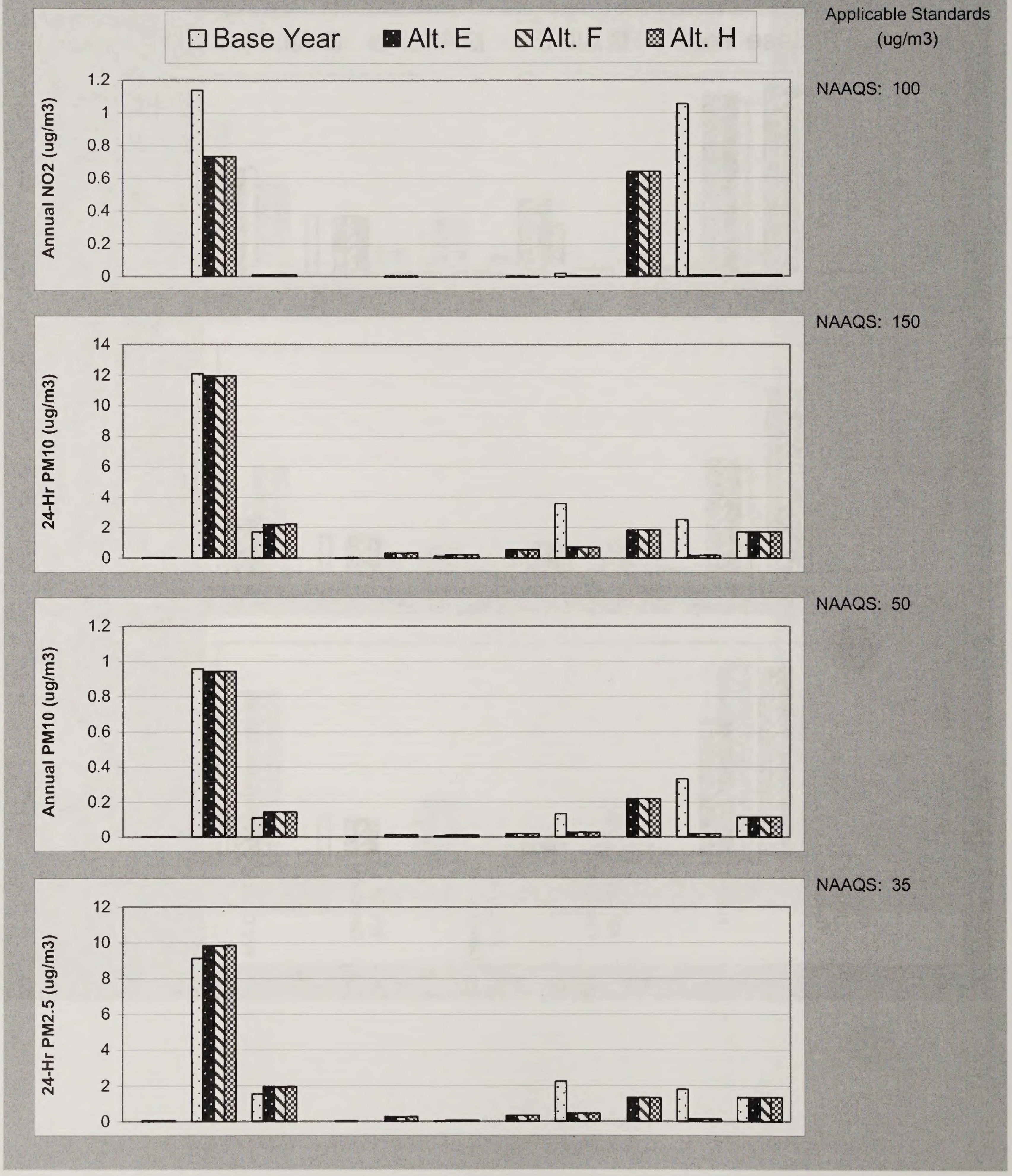
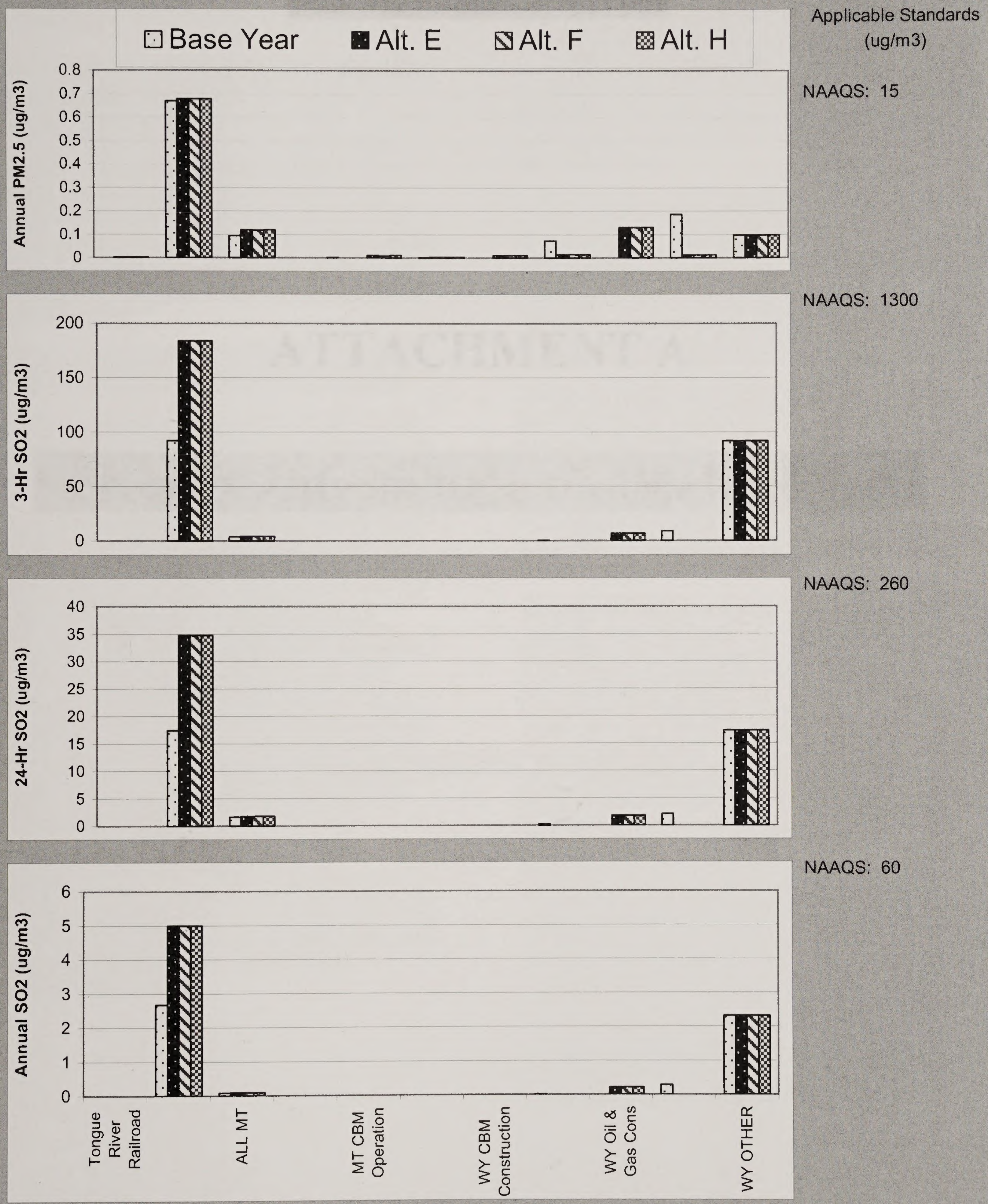


Figure 3-9 (continued)
Change in Modeled Concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$
Wind River Indian Reservation



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ATTACHMENT A

Review of Information on Health Effects

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Attachment A

REVIEW OF INFORMATION ON HEALTH EFFECTS

Introduction

In response to the findings of ambient air quality potential impacts in the Powder River Basin of Montana and Wyoming, resulting from current and projected development, this Attachment contains a summary of published information regarding potential health effects from Particulate Matter (PM). The modeled impacts showed the potential for PM_{10} concentrations to exceed the 24-hour ambient standards. The modeled exceedances were confined to a small number of receptors generally near major source development, such as coal fired power plants and coal mines.

Air monitoring station data collected for 2004 in Montana showed no exceedances of the 24-hour PM_{10} standard.

PM10 Health Effects: The health effects of short-term particulate concentrations on the public health have been reviewed in great detail, and were again reviewed as a part of the EPA-mandated evaluation of current ambient air quality standards. The most recent review (EPA 2004: *Air Quality Criteria for Particulate Matter,* EPA/600-P-99/002aF, October 2004) focuses on the establishment of the alternate $PM_{2.5}$ standards and discussed PM levels in general. The study summarizes both morbidity and mortality of potential impacts for both short term and long term exposures. The current standards for PM_{10} (150 $\mu g/m^3$ for 24 hours and 50 $\mu g/m^3$ for annual standards) are focused on protecting against morbidity and mortality effects. The study re-iterates a previous conclusion that "Efforts to quantify the number of deaths attributable to, and the years of life lost to, ambient PM exposures are currently subject to much uncertainty."

Recently a new PM standard ($PM_{2.5}$) has been promulgated, and state regulatory agencies are currently implementing programs to address those standards. $PM_{2.5}$ levels are being measured at Lame Deer in the study area, and results show that those levels are below the established ambient standards.

The potential impacts of PM concentrations are focused on sensitive populations, including those with existing cardiopulmonary disease. Nine percent of adults and eleven percent of children are diagnosed with asthma. There is some evidence that socioeconomic status also plays a role in predicting exposure and impact of PM levels of concern.

The study concludes that "Of concentration–response functions for PM-related effects, it can generally be said that the effect estimates are small in magnitude. In historical episodes with very high air pollution levels, risks on the order of a four-fold increase in mortality were estimated, but much smaller risk estimates have been reported from recent studies at current pollution levels."

"Relative risk estimates for total mortality from the prospective cohort studies fall in the range of 7 to 13 percent increase per 10 $\mu g/m^3$ increase in $PM_{2.5}$; there are no significant associations with long-term exposure to $PM_{10-2.5}$. Risk estimates from the short-term exposure studies are considerably smaller in magnitude, on the order of 2 to 6 percent increase in mortality per 25 $\mu g/m^3$ increase in $PM_{2.5}$ and $PM_{10-2.5}$."

"Effect estimates for morbidity responses to short-term changes in PM tend to be larger in magnitude that those for mortality; those for hospitalization generally range from 4-10 percent increases for cardiovascular diseases and 5-15 percent increases for respiratory diseases per 25 $\mu g/m^3$ increase in $PM_{2.5}$ and $PM_{10-2.5}$. From the more recent studies on visits to the emergency department or physicians' offices for respiratory conditions, effect estimate sizes have been somewhat larger, ranging up to about 35 percent per 25 $\mu g/m^3$ increase in $PM_{2.5}$."

As is indicated in the referenced EPA study, the predictive impact of these studies on individual small communities is subject to much uncertainty. However, given the fact that predicted impacts that exceed the 24-hour ambient air quality standard for PM_{10} are in remote, generally unpopulated areas, and that sensitive populations would generally not be confined to these areas, it is unlikely that the modeled impacts of PM_{10} levels would lead to any actual increase in morbidity or mortality of specific receptor populations.

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ATTACHMENT B

Review of Mitigation Measures

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Attachment B

REVIEW OF MITIGATION MEASURES

Model results have indicated the potential for PM_{10} to exceed the 24-hour regulatory standard. In addition, both PM_{10} and NO_x have the potential to impact visibility within PSD Class I and Class II areas. The following mitigation measures for PM and NO_x are those that are commonly employed to control air emissions. Other mitigation measures could be employed to achieve a desired control, including in tribal designated Class I areas, such as the Northern Cheyenne Indian Reservation. Additionally, through the air permitting process regulatory agencies may require specific controls based on the volume and type of emissions or the location of the emission source.

Mitigation of PM: Emissions of $PM_{2.5}$ and PM_{10} from industrial operations can be subjected to a wide range of mitigation activities or controls. Emissions of these pollutants from industrial sources, including stacks or vents, are often controlled satisfactorily by employing bag filters or electrostatic precipitators. Emissions of $PM_{2.5}$ and PM_{10} from these sources is generally subjected to review by air permitting agencies, because the nature of the source would trigger the need to obtain an air permit to construct such a facility. Any modifications to those facilities would also trigger the need to obtain such a permit. As a part of the review of those permits, agencies ensure that emissions are controlled and that impacts are with acceptable concentrations.

The $PM_{2.5}$ and PM_{10} emissions from fugitive sources, such as material stockpiles, construction operations, and material handling operations are also subject to potential mitigating controls. As impacts are identified, any impacts of concern can be addressed by imposing the related mitigation measures.

In general the mitigation measures that can be employed for materials handling, construction, hauling operations, and storage activities can be summarized as in the list of activities below.

(1) Surface exposure. When vegetation is removed from the right-of-ways for hauling or construction activities, applicants shall clear the smallest possible amount of cover to minimize the impact of wind erosion and fugitive dust.

(2) Revegetation. Where vegetation has been removed, and soils exposed, begin revegetation as soon as possible, and enhance revegetation with mulching or matting to stabilize the surface and promote plant growth.

(3) Construction or soil excavation. For exposed active construction surfaces and related stockpiles, include dust suppression activities such as surface watering or stabilization with chemical surfactants.

(4) Construction and handling during windy periods. Restrict construction or material handling operations during periods with high winds, such as a threshold of 30 miles per hour. Enhance surface water sprays as an option.

(5) Hauling operations. Maintain all haul roads that are continually active by surface watering, chemical stabilization, restricted vehicle speeds, and removal of all spillage onto the roadway surface. Cover and maintain the roadways with dust-inhibiting material to include gravel or small rocks.

(6) Construction equipment operations. Require the use of high quality (low sulfur) diesel fuel in all diesel-fired construction or operational engines. Maintain all engines in satisfactory operating conditions.

Mitigation of NO_x: NO_x, which includes nitrogen oxide (NO) and nitrogen dioxide (NO_2), is produced as a byproduct of combustion. Efforts aimed at controlling NO_x emissions and ambient air impacts can be focused on either decreasing the emissions or increasing the dispersion.

The EPA has researched mechanisms that govern the formation of NO_x during combustion as a basis for reducing NO_x emissions from combustion sources. EPA's early efforts focused on the prevention of NO_x through modification of the combustion process, since this approach held the promise of higher emissions reductions and greater economic efficiency than the use of flue gas treatment for NO_x control. There have been significant advances in combustion technology which can reduce the primary production of NO_2 at the combustion source. Control of NO_x is a complex process affected by the nitrogen content of the fuel, the amount and distribution of air in the combustion process, temperature, unit load, and burner design, among other factors. Therefore, NO_x emissions can vary significantly with changes in temperature and air/fuel mixing, and are controlled primarily by modifying the basic combustion process, with thc result that combustion modification NO_x controls

directly affect not only emissions, but often the efficiency and operability of the unit as well.

Flue gas control of NO_x consists of adding secondary control systems to the exhaust gas from a combustion process. Types of secondary control systems include selective catalytic systems, non-selective catalytic systems, chemical scrubbers, and wet scrubbers. In most cases, these types of control systems require periodic replacement, regeneration, or disposal of wastes resulting from their actions, which leads to increased costs for operation.

Another alternative for NO_x emissions control is to eliminate the combustion source and replace it with an electric process. Electric motors can be used to replace combustion driven engines.

Increased dispersion of NO_x emissions does not reduce emissions at the source, but acts to reduce near field impacts by spreading the emissions over a larger area. Enhanced dispersion can be achieved by increasing the buoyancy of the emissions or increasing the height of the emissions release in relation to the topographic surroundings. Buoyancy can be increased by increasing the temperature of the exhaust or by increasing the exhaust flow velocity. Release height is governed by good engineering practices, which limits the actual stack height allowed in relation to existing surrounding features, or a maximum allowable height, whichever is less.

Another mitigation alternative includes the regulatory permitting process, which would act to protect ambient air quality by preventing the issuance of permits in areas that would experience significant impacts from additional permitted sources.

The following mitigation measure are commonly employed to prevent potential impacts from NO_x which could lead to exceedances of federal or state ambient air quality standards:

(1) Implement Best Available Control Technology (BACT) for the emissions unit. For compressor engines, this can result in NO_x emission rate of 1 g/bhp-hr, which is lower than the 1.5 g/bhp-hr rate used in the modeling.

(2) Utilize electric powered compressor engines in place of fuel combustion sources. Using electric-powered compressor motors in place of the typical natural gas-fired compressor engines could eliminate primary NO_x emissions from compressor stations.

(3) Use alternative fuels, which have lower fuel nitrogen content. Natural gas-fired compressor engines typically have lower NO_x emissions than diesel-fired engines.

(4) Increase dispersion of NOx emissions to reduce near field impacts by spreading emissions over a larger area.

(5) Use of regulatory permitting to prevent new or additional sources into areas where their emissions would cause significant impacts to ambient air quality identified through the permitting process.

HYDROLOGY APPENDIX

Summary of Water Resources Technical Report

Introduction

During the second half of the 1990s, coal bed methane (CBNG) production increased dramatically nationwide to represent a significant new source of natural gas to meet ever-growing energy demands. In Montana, oil & gas development has been growing since the first oil wells were drilled in the early 20th century. There are currently more than 200 commercially producing CBNG wells in the state of Montana, all of which are located in the Powder River Basin near the town of Decker, Montana. CBNG development in the Montana portion of the Powder River Basin (PRB) is in part a result of successful development in the Wyoming portion of the basin where CBNG activity started as early as 1993 (Flores et al. 2001).

A primary intent of the Montana CBNG Environmental Impact Statement (EIS) is to provide an overall projection of impacts associated with CBNG development for the planning areas and to address issues raised as part of the public scoping process. Of primary consideration for the EIS are water resources. Due to the extraction methods required for CBNG production, impacts to surface water and groundwater can potentially result from CBNG development. The purpose of the Water Resources Technical Report (WRTR) (ALL 2001b) is to serve as one of many supporting documents for the subject EIS. Following is a short summary of the WRTR.

Study Area

The planning area for the EIS is defined as the area where oil and gas decisions will be made by the BLM and the State of Montana. The BLM's planning area is the oil and gas estate administered by the BLM in the Powder River and Billings Resource Management Planning (RMP) areas. The State of Montana's planning area is statewide, with emphasis on the state-administered oil and gas within the BLM planning area and in Blaine, Park and Gallatin counties. The planning area excludes those lands administered by other agencies (for example, Forest Service and Tribal Councils). For ease of reference, the Billings and Powder River RMP areas, and Blaine, Park, and Gallatin counties, are referred to in the document as the BLM and State "CBNG emphasis area." This is the 16-county area within the BLM and state planning area where CBNG development interest has been identified.

CBNG Production Operations

During CBNG production, water is pumped up a tubing string to be put into a water flow-line for handling or discharge. At the only producing CBNG field in the Montana portion of the PRB, the water is either used in drilling new wells, pumped into ponds for use by the land owner, or discharged to the Tongue River through a MDEQ discharge permit. Assessment of management alternatives requires an accurate estimate of the amount of produced water to be produced from each well. CBNG wells must pump water from the reservoir to lower pressure within the coal, to augment the formation of cleat, and to allow the natural gas to break out as a discrete phase. The amount of water that must be pumped off appears to vary not only from reservoir to reservoir, but also during the history of each individual producing well according to the specific coal bed reservoir it is producing from, and its proximity to other producing wells. The WRTR compiles average water production rates for approximately 200 wells in the CX field normalized to the age of each well (MBOGC oil and gas database). This data was prepared by averaging the water production rates from active CBNG wells during each month dating from the date of first production. The exponential trend line is extrapolated from this data is: $Q = 14.661e^{-0.0242t}$ When Q is discharge per well in gallons per minute (gpm), and t is time in months. This indicates that initial discharges are approximately 15 gpm per well, and the 20-year average discharge would be 2.5 gpm. It should be noted that although the average initial discharge is approximately 15 gpm, some wells have discharges as high as 20-25 gpm.

Regional Geology

The planning area of the EIS centers on the Powder River RMP area and the Billings RMP area. The planning area contains three major basinal features – Powder River, Big Horn, and Bull Mountains – and surrounding uplifted areas. The asymmetric basins are the result of sedimentary deposition and structural subsidence with most of the fill consisting of the Fort Union Formation. The Fort Union Formation also contains most of the coals occurring in these three basins.

Fort Union Formation

The Fort Union Formation encloses the various coal seams within the Montana portion of the PRB; these coals function as the source and reservoir for the CBNG, as well as aquifers carrying groundwater of varying quantity and quality. Depth to coal seams in the Montana portion of the PRB range from exposure at ground surface to 1,000 feet or more below land surface. Coal thickness varies from thin stringers to over 50 feet and can form aggregate thicknesses that exceed 100 feet. Coal seams in the Fort Union do not have significant matrix porosity and permeability; they can act as aquifers because fluids such as water and methane are contained within the coal's fracture system, known as cleat. The fractures accumulate the fluids and allow the fluids to move horizontally and vertically.

Quaternary Alluvium

Quaternary age sediments are those that are Pleistocene (the latest glacial episode) and Recent (post-glacial episode) in age; the sequence is dominated by events and effects associated with continental glaciation, including glacial till and exaggerated peri-glacial valley fill. Quaternary sediments in the PRB and most of the state are present as variable fill in stream and river valleys. Quaternary Alluvium consists of unconsolidated sand, silt, and gravel that make up the floodplains and stream terraces of creek valleys in the PRB. Alluvium aquifers are largely unconfined and connected to active river flow. Because alluvial aquifers can deliver large quantities of water-to-water supply wells, they are important stratigraphic features. Alluvial aquifers can be impacted by surface activity and can act as a conduit to carry those impacts to valuable surface water resources.

Hydrology

Hydrology identifies aquifers (porous units containing water) and aquitards (non-porous strata that serve to confine and separate aquifers) in a geographic and vertical sense. Aquifers can contain drinkable water, brackish water of limited usability, or salt water. In the EIS planning area, several formations contain drinking water but show variable reservoir quality and water quality. The Montana portion of the PRB includes many aquifers that represent different hydrologic flow regimes. The basin includes unconfined aquifers as well as confined, bedrock aquifers. Aquifers range from the unconfined Quaternary alluvium in the streambeds of rivers and creeks to the Mississippian Age Madison Formation in excess of 10,000 feet below the surface. The water quality within these aquifers ranges from less than 300 mg/L TDS to more than 30,000 mg/L TDS. The aquifers also vary in depth from the basin center to the margin. Coal aquifers are widespread, supply large numbers of water wells, and will be impacted most by CBNG production. Alluvial aquifers are commonly unconfined and in direct contact with surface water and can, therefore, be impacted by surface discharge of CBNG water.

Watersheds

Watersheds are important to predicting the impacts from CBNG development in Montana. Water resource factors such as water quality, water use, and potential impacts are discussed throughout the report in terms of watersheds. Each watershed is drained by a single stream or river and each is bounded by a no-flow topographic boundary. Streams and rivers are profoundly influenced by their watersheds; in particular water volume and water quality vary from base flow conditions to high-flow conditions under the control of runoff from land surfaces and recharge to rivers by aquifers. The WRTR highlights the watersheds in the PRB along with potential CBNG areas.

Groundwater Quality

Quality of groundwater resources are detailed in the WRTR. The report lists quality statistics for the major aquifers from various parts of the CBNG emphasis area with emphasis on the coal seam aquifers.

Water Resources Impact Issues

Groundwater Drawdown from CBNG Development

Groundwater drawdown from CBNG production has been documented inside and adjacent to existing production in Montana. CBNG production in the PRB requires drawdown of coal aquifers within the producing field in order to liberate methane. Water wells and springs to but outside of a producing CBNG field may also be impacted. Drawdown can be documented by way of dedicated monitoring wells or by gauging private water wells. In Montana's CX Ranch CBNG field, the MBMG has installed monitoring wells designed to track drawdown due to the coal mines in the area as well as CBNG development.

Surface Water Impact from Discharge

Impacts to surface water from discharge of CBNG water can be severe depending upon the quality of the CBNG water. Some watersheds may be able to absorb the discharged water while others are sensitive to large amounts of low-quality CBNG water. Surface water quality in the watersheds is tabulated in the WRTR. Water quality data is from stream gauging points maintained by the USGS; these multi-year collections of water quality data illustrate changes within the stream from times of high run-off (typically June for the PRB) when the river is the highest and water is mostly the result of precipitation from spring rains and melting snow. During periods of high flow the streams and rivers contain higher quality water. The USGS data also contains data on base-flow conditions (typically winter in the PRB) when streams are at their lowest flow and water quality is the lowest since much of the water is recharge from alluvial and bedrock aquifers where groundwater is often of low quality. Discharge scenarios are described and resultant water quality is computed on a watershed basis.

Mitigation

CBNG production in the Montana PRB will certainly impact groundwater. Impacts to groundwater resources may however be mitigated through the use of water well agreements, limits placed on discharge and monitoring programs. Furthermore, a predictive model may be helpful as an approximation of future impacts. Groundwater rights will be protected through the use of spring/water well mitigation agreements and an approved monitoring plan to aid in the identification of potentially significant drawdown impacts. Surface water resources can be protected by limiting discharge through alternative management techniques.

Conclusions and Attachments

The WRTR concludes with a list of key water resource factors that are important to the subject of impacts. The appendices contain several pertinent documents as well as groundwater drawdown data from monitoring wells in the vicinity of the CX Ranch field, decline analysis from the CX Ranch field, and groundwater quality data from coal seam aquifers.

TMDL Schedule for CBNG Emphasis Area of Montana

Section 303 (d) of the Federal Clean Water Act and Sections 75-5-701 MCA, et. seq. of the Montana Water Quality Act requires Montana to develop "Total Maximum Daily Loads" (TMDLs) for lakes, rivers, and streams that are not meeting water quality standards. A TMDL is the amount of a pollutant that a waterbody can assimilate from point, non-point and natural sources and still meet water quality standards. In short, TMDLs guide the development of discharge targets for contributing sources that once implemented will restore or protect water quality.

All waters in Montana have been assigned to one of nine classifications based upon their presumed ability to support certain beneficial uses (i.e. drinking water, recreation, fisheries and aquatic life, agriculture, and industrial uses). Each classification has specific water quality standards including numerical and narrative limits. Waters that fail to meet the numerical or narrative standards are considered impaired. Montana must develop one or more TMDLs for each impaired waterbody.

In accordance with Section 303(d) of the Federal Clean Water Act, the Montana Department of Environmental Quality (MDEQ) has prepared a list of impaired and threatened waters every two years since 1992. This so called "303(d) list" identifies lakes, rivers and streams that are not meeting water quality standards and establishes priorities for TMDL development. However, Montana like the rest of the nation was slow to develop TMDLs.

On June 21, 2000, the United States District Court of Montana ordered EPA to work with the State of Montana to develop and adopt a schedule that would result in developing all necessary TMDLs for waters on Montana's 1996 Section 303(d) list (EIS Table 3-6) by May 5, 2007. On November 1, 2000, MDEQ and EPA published a schedule that was based upon a watershed or planning area approach. MDEQ divided the state into 91 TMDL Planning Areas each with a deadline for completing all necessary TMDLs. Since that time, an agreement has been reached to extend these timelines such that all TMDLs will be completed prior to May 5, 2012 (Yashan, pers. com., 12/8/05). This revised schedule is shown graphically on Figure HYD-1. The surface waters most likely to be affected by CBNG development are located in the Tongue Powder and Rosebud TMDL Planning Areas. The TMDL analyses for these areas are currently underway.

Independent of the court order, but as required by the Federal Clean Water Act and the Montana Water Quality Act, MDEQ prepared a 303(d) list in 2004. The 2004 list was finalized with EPA approval on November 24, 2004. It is superior to earlier lists for several reasons. First, significantly more data was available for making listing decisions. Second, the public review process was substantially expanded including a lengthy comment period and public meetings around the state. Third, MDEQ significantly improved the methods for making listing decisions. Fourth, MDEQ dramatically improved the supporting documentation for all listing decisions and made the information easily accessible by the public.

Although the court order mandates the 1996 list (EIS Table 3-6) as the starting point, both the 1996 and the 2004 lists should be consulted when making TMDL decisions. Figures HYD-2 to HYD-4 provides a summary of the waters in the Tongue, and Rosebud Creek basins that are on the 2004 list. No segments of the Powder River are on the 2004 list. The accompanying tables (Tables HYD-1 to HYD-3) identify the pollutants of concern and summarize the reasons for the listings.

The MDEQ or EPA is required to develop *all necessary* TMDLs for each waterbody and pollutant identified as impaired or threatened on the 1996 list. A TMDL may not be necessary for a waterbody listed on the 1996 list for a couple of reasons. First, a TMDL is unnecessary if further assessment, such as was done for the 2004 list, determines that the waterbody is meeting water quality standards for the particular pollutant. During the development of the 2000, 2002, and 2004 lists, MDEQ determined that several waters in the Tongue, Powder, and Little Powder river basins that were listed as impaired on the 1996 list, were actually meeting water quality standards (i.e., Mizpah Creek was found to be fully supporting for nutrients, dissolved oxygen, inorganics and suspended solids). Second, EPA has determined that TMDLs are not necessary for "pollution" that is not associated with a specific pollutant (i.e., flow or habitat alteration). EPA described their position on this issue to MDEQ in a July 23, 2001 letter concerning a flow alteration TMDL for Big Creek, a tributary of the Upper Yellowstone River. It should be noted however, that further assessment frequently shows that flow or habitat alterations cause high levels of pollutants (i.e., flow and habitat alteration can cause violations of temperature standards).

Figure HYD-1:
A graphical display of MDEQ's TMDL Planning Schedule (obtained from P. Schade (MDEQ) on 12/9/05).

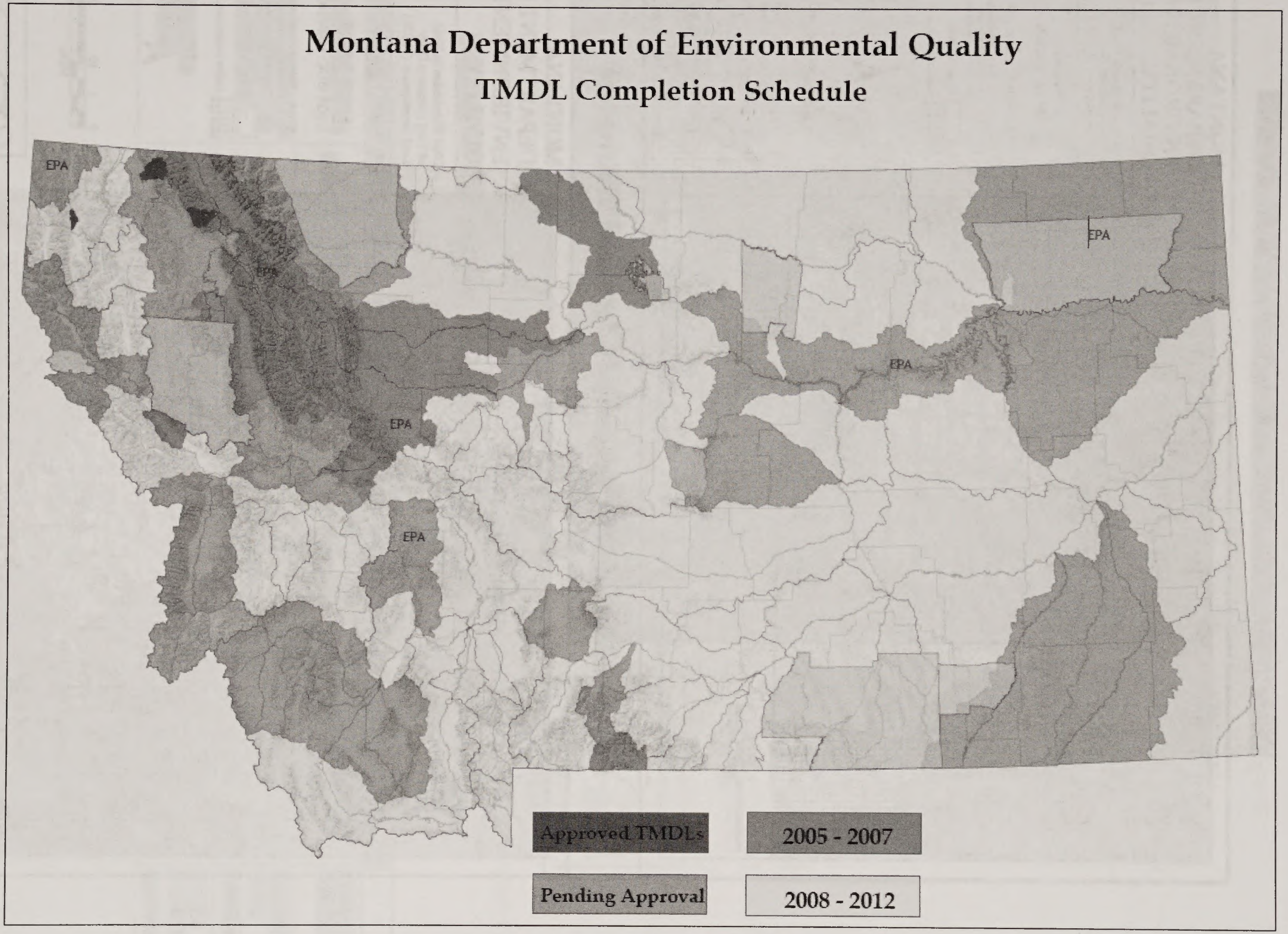


Figure HYD-2: Impaired Waterbodies in the Upper Tongue Watershed

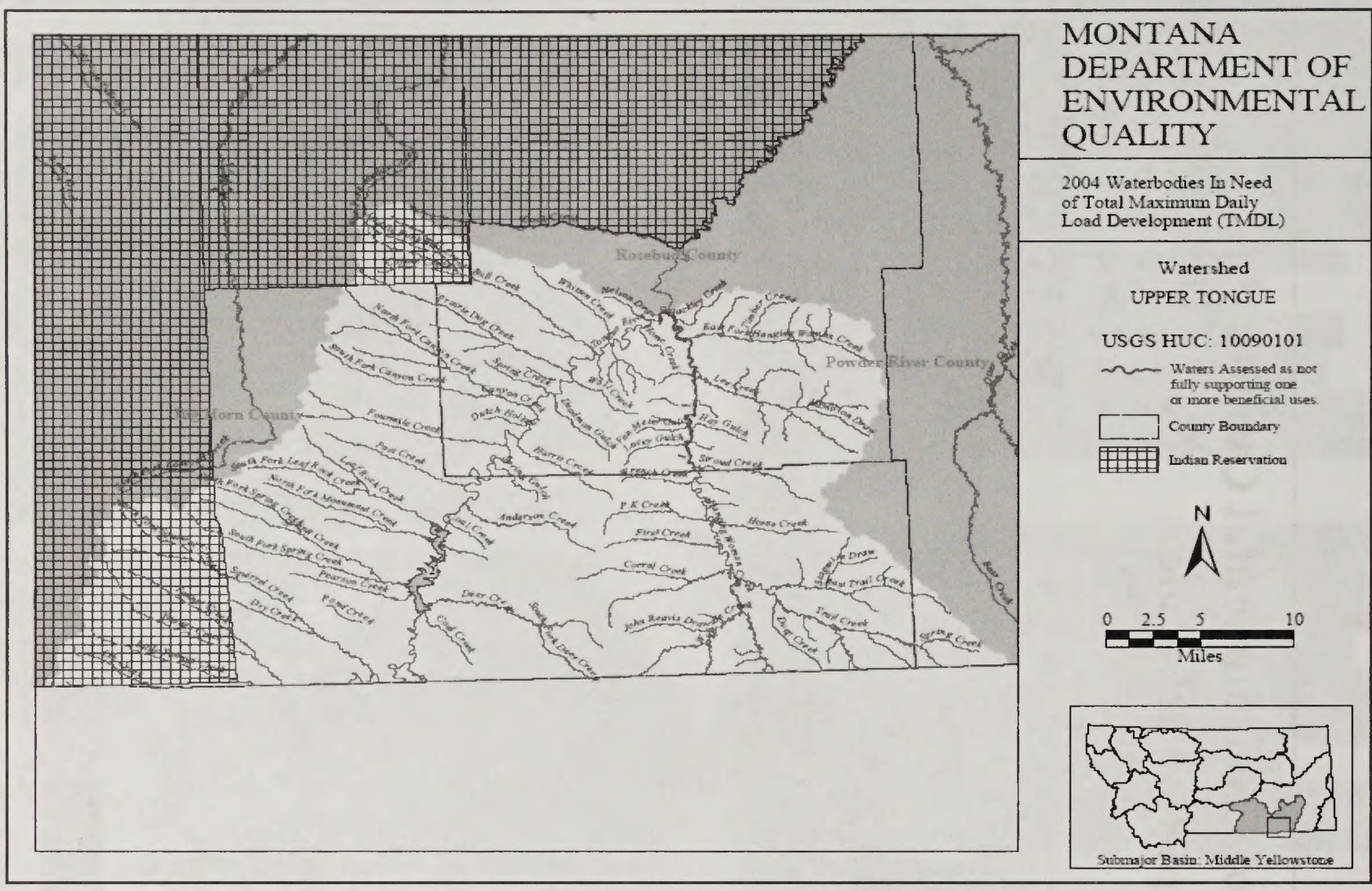


Figure HYD-3: Impaired Waterbodies in the Lower Tongue River Watershed

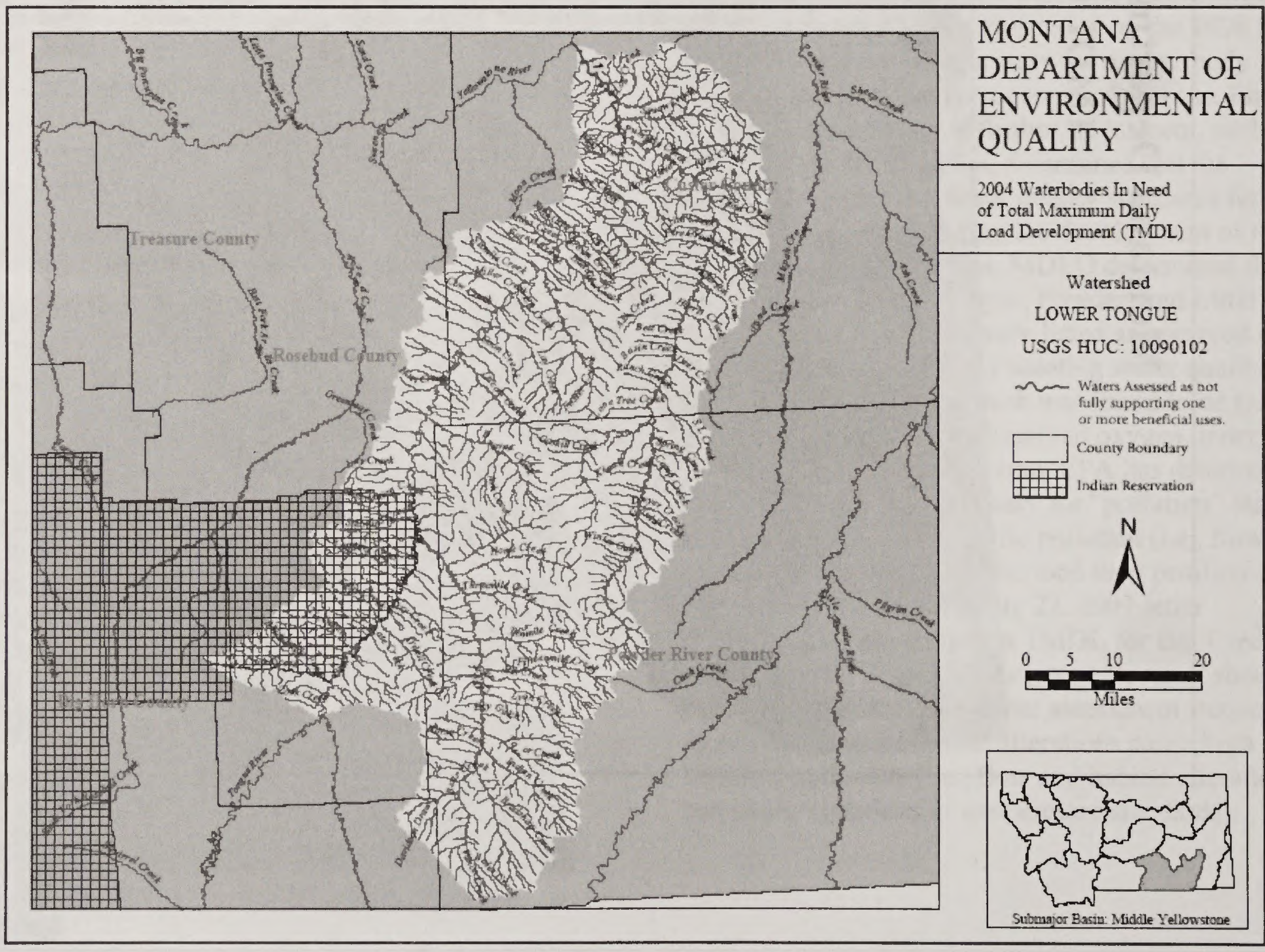


Figure HYD-4: Impaired Waterbodies in the Rosebud Creek Watershed

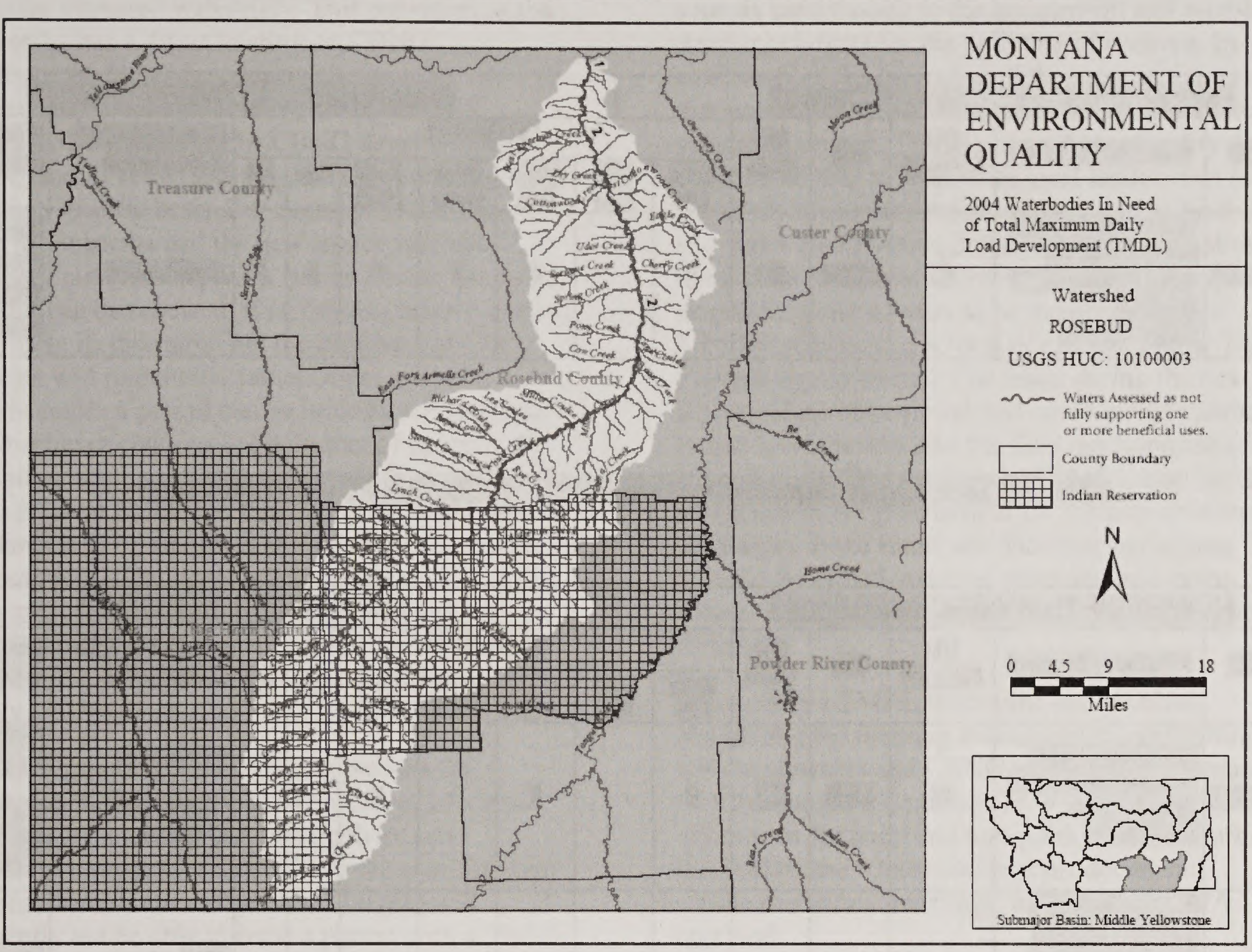


Table HYD-1: List of Impaired Waterbodies in the Upper Tongue River Watershed

Hydrologic Unit Code	10090101					Watershed	UPPER TONGUE							
ID	Segment ID	Waterbody Segment	List Category	Size	Use Class	Use Support							Probable Causes of Impairment	Probable Sources of Impairment
						Aqua Life	Cold Fish	Warm Fish	Drink Water	Swim (Rec)	Agri	Ind		
1	MT42B002_031	Hanging Women Creek from Stroud Cr. To the mouth (Tongue R.)	5	18.5 M	C-3	P		P		X			Siltation	Grazing related sources Agriculture
2	MT42B003_010	Tongue River Reservoir	5	3500 A	B-2	P	X		X	P	F	F	Algal Growth/Chlorophyll a	Domestic wastewater lagoon Agriculture

Table HYD-2: List of Impaired Waterbodies in the Lower Tongue River Watershed

Hydrologic Unit Code 10090102						Watershed LOWER TONGUE								
ID	Segment ID	Waterbody Segment	List Category	Size	Use Class	Use Support							Probable Causes of Impairment	Probable Sources of Impairment
						Aqua Life	Cold Fish	Warm Fish	Drink Water	Swim (Rec)	Agri	Ind		
1	MT42C001_011	TONGUE RIVER from diversion dam just above Pumpkin Cr. To the mouth (Yellowstone R.)	4C	20.4 M	B-3	P		P	X	P	F	F	Flow alteration	Dam Construction Flow Regulation/ Modification Hydromodification

Table HYD-3: List of Impaired Waterbodies in the Rosebud Creek Watershed

Hydrologic Unit Code 10100003						Watershed ROSEBUD								
ID	Segment ID	Waterbody Segment	List Category	Size	Use Class	Use Support							Probable Causes of Impairment	Probable Sources of Impairment
						Aqua Life	Cold Fish	Warm Fish	Drink Water	Swim (Rec)	Agri	Ind		
1	MT42A001_011	ROSEBUD CREEK, From the mouth 3.8 mi upstream to an irrigation dam	4C	3.8 M	C-3	P		P		X			Bank erosion Other habitat alterations	Removal of Riparian Vegetation Habitat Modification (other than Hydromodification)
2	MT42A001_012	ROSEBUD CREEK, Northern Cheyenne Res. Boundary to an irrigation dam 3.8 mi above the mouth	5	105.8 M	C-3	X		P		X			Other Nutrients	Dam Construction Hydromodification

Although, during the preparation of the 2000, 2002, and 2004 lists the MDEQ determined that several waterbodies on the 1996 list were meeting the water quality standards for some of the listed pollutants, it was far more common for MDEQ to determine that there was insufficient credible data to make a listing decision. MDEQ determined that many segments of the Tongue and Powder rivers and some tributaries lacked sufficient credible data to determine whether the waters are impaired, threatened, or fully supporting the numerical and narrative water quality standards. These waters require additional assessment prior to developing TMDLs for the associated TMDL Planning Areas. The reassessment work has been conducted, and MDEQ is in the process of evaluating that data. It is possible that MDEQ will determine that additional waterbodies are meeting the standards for listed pollutants. If so, a TMDL will not be necessary, even though the waterbody and the pollutant were listed on the 1996 list. Conversely, additional TMDLs may be necessary if the assessment demonstrates that a waterbody is impaired for other pollutants that were not originally identified on the 1996 list.

The 1996 list identified many waters within the Tongue and Powder TMDL planning areas as impaired by salinity, total dissolved solids, chlorides, metals, inorganics, suspended solids, siltation, nutrients, low dissolved oxygen, pathogens, flow alteration, thermal modification, and habitat alteration. Of these pollutants, salinity, total dissolved solids, metals, and nutrients are frequently associated with produced water from CBNG development. CBNG development may also cause flow alterations and associated pollutants to exceed standards (i.e., total suspended solids).

As mentioned earlier, the court order prohibits MDEQ from issuing any new MPDES permits or renewals that would increase permitted discharges

until all necessary TMDLs are established for a particular impaired waterbody. This provision of the court order has a direct bearing on CBNG development. Unless producers choose a no discharge option, such as reinjection, MPDES permits will be required for CBNG development. MDEQ and EPA are applying the court order on a pollutant-specific basis. For example, if the water is listed for nutrients and the new source will not discharge nutrients, a permit can be issued. Likewise, a permit can be renewed, if an existing source intends to increase its discharge but the effluent limit for nutrients will remain the same. Under some circumstances a permit can be issued even when the new discharge contains the pollutant of concern. By regulation, such permits must contain water quality based effluent limits that insure that the water quality standards will be met downstream of the discharge. For example, if the water quality standard is expressed as an in-stream concentration and the concentration in the discharge is less than the standard, the new source may actually improve water quality.

MDEQ is prohibited from issuing permits for discharges that would cause exceedances of a state water quality standard (i.e., where there is no assimilative capacity). This will be the case for many impaired waterbodies. Therefore, MDEQ will frequently not be able to issue a permit until a TMDL is developed for the entire watershed. A watershed TMDL will identify the major point and non-point sources contributing to the impairment and establish discharge targets for the pollutant of concern. In combination, the limits for all the sources must insure that water quality will improve to the point where the standards are met. The Montana Water Quality Act requires MDEQ to work with local landowners to implement voluntary measures (reasonable land soil and water conservation practices) to reduce pollutant loads from non-point sources. The Act also requires targets for point sources to be incorporated into MPDES permits in the form of effluent limits. The changes would normally be made during the next scheduled permit renewal and could include permits issued between now and the final development of the watershed TMDL. A watershed TMDL may include an allocation for growth to allow for new or increased discharges in the future and facilitate permitting. To provide for growth existing point and non-point sources would need to reduce their discharges even further.

Developing a TMDL takes time and involves completing the ongoing assessments; coordinating with landowners and CBNG producers in Montana, on tribal lands, and perhaps in Wyoming; assigning allocations for point and non-point sources; drafting the TMDL and a technical support document; conducting public meetings; and obtaining EPA approval.

Specific Electrical Conductivity (EC as uS/cm) and Sodium Adsorption Ratio (SAR) Limits for the Tongue, Powder, and Little Powder River Basins and Rosebud Creek

MONTANA DEQ NUMERIC STANDARDS FOR ELECTRICAL CONDUCTIVITY (EC) AND SODIUM ADSORPTION RATIO (SAR). ARM 17.30.670

(1) No person may violate the numeric water quality standards or the criteria for determining nonsignificant changes in water quality identified in (2) through (6). Compliance with the standards and criteria contained in (2) through (6) will be determined according to the procedures specified in (7).

(2) The numeric standards for electrical conductivity (EC) and sodium adsorption ratio (SAR) for the mainstems of Rosebud Creek, the Tongue, Powder, and Little Powder rivers from November 1 through March 1 are as follows:

(a) for Rosebud Creek and the Tongue River, the monthly average numeric water quality standard for EC is 1500 µS/cm and no sample may exceed an EC value of 2500 µS/cm. The monthly average numeric water quality standard for SAR is 5.0 and no sample may exceed an SAR value of 7.5; and

(b) for the Powder River and the Little Powder River, the monthly average numeric water quality standard for EC is 2500 µS/cm and no sample may exceed an EC value of 2500 µS/cm. The monthly average numeric water quality standard for SAR is 6.5 and no sample may exceed an SAR value of 9.75.

(3) The numeric standards for EC and SAR for the mainstems of Rosebud Creek, the Tongue, Powder, and Little Powder rivers from March 2 through October 31 are as follows:

(a) for Rosebud Creek and the Tongue River, the monthly average numeric water quality standard for EC is 1000 µS/cm and no sample may exceed an EC value of 1500 µS/cm. The monthly average numeric water quality standard for SAR is 3.0 and no sample may exceed an SAR value of 4.5; and

(b) for the Powder River and Little Powder River, the monthly average numeric water quality standard for EC is 2000 µS/cm and no sample may exceed an EC value of 2500 µS/cm. The monthly average numeric water quality standard for SAR is 5.0 and no sample may exceed an SAR value of 7.5.

(4) For all tributaries and other surface waters in the Rosebud Creek, Tongue, Powder, and Little Powder River watersheds, the monthly average numeric water quality standard for EC is 500 µS/cm and no sample may exceed an EC value of 500 µS/cm. The monthly average numeric water quality standard for SAR from March 2 through October 31 is 3.0 and no sample may exceed an SAR value of 4.5. The monthly average numeric water quality standard for SAR from November 1 through March 1 is 5.0 and no sample may exceed an SAR value of 7.5.

(5) For the Tongue River Reservoir, the monthly average numeric water quality standard for EC is 1000 µS/cm and no sample may exceed an EC value of 1500 µS/cm. The monthly average numeric water quality standard for SAR is 3.0 and no sample may exceed an SAR value of 4.5.

(6) Changes in existing surface or ground water quality with respect to EC and SAR are nonsignificant according to the criteria in 75-5-301(5)(c), MCA, provided that the change will not have a measurable effect on any existing or anticipated use or cause measurable changes in aquatic life or ecological integrity.

(7) For purposes of determining compliance with the water quality standards and nonsignificance criteria for all parameters of concern in any new or increased discharge of unaltered ground water from coal bed methane development, the department shall determine effluent or compliance limits (e.g., evaluate the design of disposal systems) by using a flow-based analysis that considers a range of flows or monthly flow probability. With respect to EC and SAR, the department shall also use the median chemistry for the specified flow range or monthly flow.

(8) If any of the provisions of (6) or (7), or both of them, are declared to be invalid, then the numeric water quality standards and requirements specified in (1) through (7) shall be void. (History: 75-5-301, 75-5-303, MCA; IMP, 75-5-301, 75-5-303, MCA; NEW, 2003 MAR p. 779, Eff. 4/25/03.)

Montana Board of Environmental Review
March 23, 2006 Decisions Concerning New CBNG Water Quality Rules

Adopted

The Montana Board of Environmental Review (BER) adopted new rules for EC and SAR to be changed to harmful parameters. This designation triggers the non-degradation criteria under the Montana Pollutant Discharge Elimination System (MPDES) permitting process. It is consistent with Montana's management of other parameters with numerical water quality standards. The essence of the non-degradation criteria is to protect high quality state waters and limit discharges so changes to water quality would always result in levels of "harmful parameters" (in this case EC and SAR) between existing water quality levels and 40% of the existing water quality standards (there is also a 10% change limit for any discharge). For example, if the water quality standard is 1000 uS/cm a discharge permit would need to result in an instream water quality (after the mixing zone) not greater than 400 uS/cm. Whenever ambient conditions exceed 40% of the existing standards, no assimilative capacity is available, and any discharges resulting in a measurable increase would not be permitted (can not cause an increase, but could keep it the same or make it less). It should be noted that the three CBNG permits into the Tongue River already use up most of the assimilative capacity there.

This rule would apply statewide, however it is only effective at this point on water bodies with numeric water quality standards for EC and SAR (i.e., Tongue, Powder, Little Powder, and Rosebud watersheds).

Companies would have to treat water in the Tongue River to SAR and EC levels comparable to ambient water quality, which is below the existing standards if they wanted to discharge to waters of the state. Discharges into the Powder River and Little Powder River would also be limited because the ambient conditions in these water bodies often exceed 40% of existing standards. Plans for treating water by companies operating in Montana that have been approved by the Montana Department of Environmental Quality (MDEQ) involve treating water to a very low SAR, approximately 0.04, and EC to about 233 uS/cm and then mixing at a rate (approximately 75% treated water to 25% untreated water) to meet instream water quality standards at the end of pipe. Adoption of the proposed rule would probably require treatment of more water overall and curtail the ability to blend treated with untreated water before discharging.

The Wyoming DEQ would also be required to meet the non-degradation standards at the state line if the Montana standards are approved by the EPA.

The only way to obtain a permit if the 40% or 10% thresholds are exceeded would be to obtain a permit from the MDEQ to degrade. Although the MDEQ has a method for processing a permit to degrade, no such permits have ever been requested by any party in Montana.

Rejected

The BER rejected the portion of the proposed rule that requires injection of CBNG produced water and a rigorous process to bypass the requirement to use injection.

The Environmental Quality Council determined the proposed rule requiring CBNG companies to use injection as the initial method for disposal of produced water is outside of the jurisdiction of the Montana BER. Comments on the proposal from the public; the Environmental Quality Council findings; and the State's review (Montana Bureau of Mines and Geology Study) of the feasibility of injection in the Power River Basin are all reasons this portion of the rule was rejected.

Other Actions

The BER adopted the rule deleting the requirement to use a flow-based permit calculation method, and rejected the proposed rule to use the 7Q10 flow (lowest flow conditions). The MPDES section of the MDEQ has the discretion to use either method for calculating approved discharges for other MPDES permits, and has used both. This action

preserves the MDEQ's discretion to use either, or a combination of the two, and makes the analysis and calculation of CBNG produced water permits consistent with other MPDES efforts.

The BER postponed ruling on the requirement to treat CBNG waters and the effluent limits proposed for treatment. The BER directed the MDEQ to return a proposal to the Board on this matter after performing additional analysis of proposed effluent limitations and documentation of the technical, economic, and environmental feasibility and cost-effectiveness of those effluent limitations. This matter is scheduled to be presented to the BER at its September 29, 2006 meeting.

On March 10, 2006, the Northern Plains Resource Council (NPRC) proposed amending its own petition regarding effluent limits with an EPA-recommended statistical approach. This was proposed in response to numerous comments received on effluent limits of the proposed rule. The NPRC's March 10 proposal also included exceptions to a requirement to treat CBNG water for any permitted beneficial uses. No interested parties were provided an opportunity to review or comment on the amended language provided by the NPRC. The BER did not consider the March 10 proposal a part of the proposed rule making under review.

WQS for Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR) Adopted by the Northern Cheyenne Tribe

The Northern Cheyenne Tribe's EC and SAR numerical standards were adopted by the Tribal Council on May 28, 2002. The numerical standards apply to the Tongue River, Rosebud Creek and tributaries to each within the boundaries of the Reservation.

Tongue River and Rosebud Creek (within the Reservation Boundaries)	**Irrigation Season (4/1 - 11/15)**	**Criteria Applicable All Year**		**Notes**
	EC (30-day ave.)	EC (inst. max.)	SAR (inst. max.)	The Tribe has also adopted indicator values for total dissolved solids (TDS) that will be used to monitor conditions and trends of these waters.
Southern Boundary	1000	2000	2.0	
Northern Boundary	1500	2000	3.0	
Tributaries	1500	2000	3.0	

EXAMPLE WATER WELL MITIGATION AGREEMENT

WHEREAS, Owner has existing water wells within its property boundaries, providing Owner water for domestic and agricultural/livestock water, and

WHEREAS, Operator has acquired leases for the development of Coalbed Natural Gas (CBNG) and intends to drill and complete wells for production of CBNG, and

WHEREAS, the development and production of CBNG usually requires the production of water in conjunction with CBNG and may require the localized reduction of water levels within certain individual strata of the Ft. Union Coals, and

WHEREAS, Operator has advised Owner that the production of water in association with gas could adversely affect the productive capacity of Owner's existing water wells which draw water from the Ft. Union aquifer.

NOW, THEREFORE, as consideration for the mutual covenants herein, in order to facilitate the multiple usage of the natural resources consistent with sound environmental practices, to mitigate potential adverse affects on the Owner's water wells, to assure prompt and effective remediation, and to reduce the need for regulatory intervention by State and Federal agencies, the Owner and Operator agree as follows:

DEFINITIONS

Ft. Union Coals – The Ft. Union Coals, as used herein, shall mean those individual coalbeds or several coal beds contained within the Tongue River member of the Ft. Union Formation, bounded above by the Wasatch Formation of Eocene, and below by the Lebo Shale member.

Circle of Influence (COI) – The area that falls within a circle, the center of which is the location of a producing CBNG well, which has a radius of one mile (5,280 feet).

Impaired Water Well – Any water well or spring existing on the Owner's property within the COI, existing at the time of the CBNG development, that experiences a reduction of capacity to deliver water in quantity and/or quality sufficient to support the ordinary and customary use of the well or spring.

Strat Test – Any test well that is drilled with the purpose of obtaining geologic information that is not completed for production and is subsequently plugged and abandoned. Strat test may produce water and/or gas for a period not to exceed thirty (30) days without creating a COI.

CBNG Well – Any well drilled and completed for the production of CBNG that withdraws water and/or gas and water from the aquifer for a period exceeding sixty (60) days.

AGREEMENT

1. Upon the establishment of a COI, the Operator, at its sole cost and risk, will measure, or cause to be measured, the static water level and productive capacity ("the baseline measurement") of all water wells and springs within the COI and will attempt to determine the depth and configuration of these wells through consultation with the Owner and from the records of the Montana Department of Natural Resources. Upon request, Owner shall provide Operator with the location of all wells and springs within one mile of Operator's drilling operations. The Operator shall also test for the presence of methane in the water wells.

2. Owner shall, upon reasonable notice, allow the testing of water wells and springs within COI, including a static water level test which may require the cessation of withdrawals of water from the well or spring for a period not to exceed twenty-four (24) hours.

3. Operator shall establish a continuing water well monitoring program, the intent of which is to enable the Operator to identify changes in capacity of the Owner's water wells and springs within the COI. The Owner shall allow continued periodic testing of the water wells and springs within the COI for this purpose. Operator shall immediately provide all test data, both "baseline data" and monitoring data, to the Owner as it is acquired by Operator.

4. If a water well or spring within the COI becomes impaired as defined herein, Owner shall first take reasonable steps to verify that the impairment is not due to mechanical, electrical, down hole integrity, or pump problems, and, if none of these problems appear to be the cause of the impairment, Owner shall notify Operator of the impairment. Notice shall be made by phone and by writing, delivered by hand or by registered mail to the Operator at the above address.

5. Within sixty (60) days of the receipt of notice of impairment, Operator shall restore the Owner's access to water of sufficient quantity and quality to offset such impairment by reconfiguring, redrilling the well, the drilling of a new well, or by other means. It is recognized that additional power costs may be associated with any reconfiguration of an impaired water well which additional power costs shall be paid for by the Operator. The specific site of the well or water access may be changed by mutual agreement of Operator and Owner.

6. Operator agrees that upon notice of impairment and during the curative period, to provide and make available water for domestic and livestock usage in quantity, quality, and location required for the maintenance of normal and customary domestic, grazing, and livestock operations. Operator shall develop emergency procedures for immediate delivery of water to any such affected Owner within twenty-four (24) hour emergency contact. Owner shall make a good faith effort to inform Operator, by phone, fax, or other expedient method of communicating, of any impending loss or damage to livestock, allowing Operator a reasonable opportunity to mitigate such damage.

7. In the event it is determined that there is an impaired water well or spring, as defined above, in any COI, that COI shall be expanded based on the location of the impaired wells or springs. The COI shall be divided into quadrants (NE, NW, SW, SE) and based upon which quadrant the impaired water well or spring is located in, that quadrant shall be expanded by the area included within a arc one-eighth (1/8) of a miles wide (660 feet) outside the existing COI. Likewise, should it be determined that there is an impaired water well or spring within the expanded quadrant of the COI, that quadrant shall be again expanded by another 660 feet increment. This expansion approach shall be used to expand any COI in any direction where impairment is determined during the life of the CBNG well. Notwithstanding the above, if no water well or spring exists within the expanded area, the arc and associated quadrant shall be expanded to included the next nearest water well or spring.

8. At any time that the Lessee undertakes activities to enhance Owner's water well capacity or to restore Owner's impaired water well capacity, and should such activities require permits from regulatory agencies or permissions from third parties for surface entry, Owner shall aid and assist Operator in the obtaining of permits and permissions necessary to conduct the operations. All costs of the operations, including fees for obtaining permits and permissions, shall be borne by the Operator.
9. In the event that the interpretation or enforcement of this Agreement results in legal action, the costs of such action, including reasonable attorneys' fees, shall be borne by the individual parties, except in the event that the Owner is the prevailing party, in which case the Operator shall bear the costs and attorneys fees of the Owner.
10. The terms and provisions contained herein shall run with the land and shall be binding on the heirs, successors, and assigns of Owner and Operator. This Agreement shall terminate upon the expiration of the last Oil and Gas Lease or the Plugging and abandonment of the last CBNG well to which this Agreement applies, whichever is the later date.

This Agreement may be executed in any number of counterparts, each of which shall be considered an original.

OWNER:	**OPERATOR:**
Owner	Company
By:______________________________	**By:**______________________________

Montana Code Annotated 2005

TITLE 82. MINERALS, OIL, AND GAS
CHAPTER 11. OIL AND GAS CONSERVATION
Part 1. Regulation by Board of Oil and Gas Conservation

Sub-Part 175

82-11-175. Coal bed methane wells -- requirements.

(1) Coal bed methane production wells that involve the production of ground water must comply with this section.

(2) Ground water produced in association with a coal bed methane well must be managed in any of the following ways:

(a) used as irrigation or stock water or for other beneficial uses in compliance with Title 85, chapter 2, part 3;
(b) reinjected to an acceptable subsurface strata or aquifer pursuant to applicable law;
(c) discharged to the surface or surface waters subject to the permit requirements of Title 75, chapter 5; or
(d) managed through other methods allowed by law.

(3) (a) Prior to the development of a coal bed methane well that involves the production of ground water from an aquifer that is a source of supply for appropriation rights or permits to appropriate under Title 85, chapter 2, the developer of the coal bed methane well shall notify and offer a reasonable mitigation agreement to each appropriator of water who holds an appropriation right or a permit to appropriate under Title 85, chapter 2, that is for ground water and for which the point of diversion is within:

(i) 1 mile of the coal bed methane well; or
(ii) one-half mile of a well that is adversely affected by the coal bed methane well.

(b) The mitigation agreement must address the reduction or loss of water resources and must provide for prompt supplementation or replacement of water from any natural spring or water well adversely affected by the coal bed methane well. The mitigation agreement is not required to address a loss of water well productivity that does not result from a reduction in the amount of available water because of production of ground water from the coal bed methane well.

History: En. Sec. 4, Ch. 578, L. 2001; Sec. , MCA 2001; redes. by Sec. 1, Ch. 117, L. 2003.

Montana Code Annotated 2005

TITLE 76. LAND RESOURCES AND USE
CHAPTER 15. CONSERVATION DISTRICTS
Part 9. Coal Bed Methane Protection Program

76-15-901. Short title. This part may be cited as the "Coal Bed Methane Protection Act".

76-15-902. Legislative findings and declaration of purpose.

(1) The legislature finds that the need for an economical supply of clean-burning energy is a national and state priority.

(2) The legislature further finds that Montana possesses plentiful reserves of clean-burning natural gas contained in coal beds.

(3) The legislature further finds that the extraction of natural gas from coal beds may result in unanticipated adverse impacts to land and to water quality and availability.

(4) The legislature declares that there is a compelling public need to promote efforts that preserve the environment and protect the right to use and enjoy private property. The legislature further declares that the purpose of this part is to establish a long-term coal bed methane protection account and a coal bed methane protection program for the purpose of compensating private landowners and water right holders for damage to land and to water quality and availability that is attributable to the development of coal bed methane wells.

(5) The legislature further declares that the provisions of this part do not relieve coal bed methane developers or operators that own, develop, or operate coal bed methane wells and collection systems of their legal obligation to compensate landowners and water right holders for damages caused by the development of coal bed methane.

(6) The legislature further declares that the provisions of this part do not relieve coal bed methane developers or operators from:

(a) any liability associated with the exploration or development of coal bed methane; or

(b) the responsibility to comply with any applicable provision of Titles 75, 82, and 85 and any other provision of law applicable to the protection of natural resources or the environment.

76-15-903. Definitions. As used in this part, unless the context requires otherwise, the following definitions apply:

(1) "Agricultural production" means the production of:

(a) any growing grass, crops, or trees attached to the surface of the land; or

(b) farm animals with commercial value.

(2) "Coal bed methane developer or operator" means the person who acquires a lease for the purpose of extracting natural gas from a coal bed.

(3) "Department" means the department of natural resources and conservation as provided for in Title 2, chapter 15, part 33.

(4) "Emergency" means the loss of a water supply that must be replaced immediately to avoid substantial damage to a landowner or a water right holder.

76-15-904. Coal bed methane protection account -- use.

(1) There is a coal bed methane protection account in the state special revenue fund.

(2) There must be deposited in the account the proceeds from the distribution of oil and natural gas production taxes, as provided in 15-36-331.

(3) All money paid into the account must be invested by the board of investments. Earnings from investments must be deposited in the account.

(4) Subject to the conditions of subsection (5), money deposited in the account must be used to compensate landowners and water right holders for damages attributable to coal bed methane development as provided in this part.

(5) Money deposited in the fund and earnings of the fund may not be expended until after June 30, 2005. For fiscal years beginning after June 30, 2005, principal and earnings may be expended only in the case of an emergency. For fiscal years beginning after June 30, 2011, principal and earnings in the account may be expended for any purpose authorized pursuant to this part.

(6) Money in the account must be appropriated to the department for use by conservation districts that have private landowners or water right holders who qualify for compensation as provided in 76-15-905. *(Subsection (2) terminates June 30, 2011--sec. 10, Ch. 531, L. 2001.)*

76-15-905. Coal bed methane protection program -- restrictions.

(1) There is a coal bed methane protection program administered by conservation districts that have coal beds within the exterior boundary of the district or whose water sources may be adversely affected by the extraction of coal bed methane. The purpose of the coal bed methane protection program is to compensate private landowners or water right holders for damage caused by coal bed methane development.

(2) A conservation district shall establish procedures, approved by the department, for evaluating claims for compensation submitted by a landowner or water right holder. The procedures must include:

(a) a method for submitting an application for compensation for damages caused by coal bed methane development;

(b) a process for determining the cost of the damage to land, surface water, or ground water, if any, caused by coal bed methane development;

(c) the development of eligibility requirements for receiving compensation that include an applicant's access to existing sources of state funding, including state-mandated payments, that compensate for damages; and

(d) criteria for ranking applications related to available resources.

(3) An eligible recipient for compensation includes private landowners and water right holders who can demonstrate as the result of damage caused by coal bed methane development:

(a) a loss of agricultural production or a loss in the value of land;

(b) a reduction in the quantity or quality of water available from a surface water or ground water source that affects the beneficial use of water; or

(c) the contamination of surface water or ground water that prevents its beneficial use.

(4) (a) Subject to the conditions of subsections (5) through (8), an eligible landowner may be compensated for the damages incurred by the landowner for loss of agricultural production and income, lost land value, and lost value of improvements caused by coal bed methane development. A payment made under this subsection (4)(a) may only cover land directly affected by coal bed methane development.

(b) Subject to the conditions of subsections (5) through (8), an eligible water right holder may be compensated for damages caused by the contamination, diminution, or interruption of surface water or ground water.

(5) In order to qualify for a payment of damages under this section, the landowner or water right holder shall demonstrate that it is unlikely that compensation will be made by the coal bed methane developer or operator who is liable for the damage to land or the reduction in or contamination of surface water or ground water as the result of coal bed methane development.

(6) Compensation made to a landowner or a water right holder under this section may not exceed 75% of the cost of the damages. The maximum amount paid to a landowner or water right holder may not exceed $50,000.

(7) Conservation district administrative expenses for services provided under this section are eligible costs for reimbursement from the coal bed methane protection account.

(8) (a) Except as provided in subsection (8)(b), compensation for damages allowed under this section may be made only after June 30, 2011.

(b) Compensation for an emergency may be made after June 30, 2005.

MINERALS APPENDIX

MINERALS APPENDIX

Introduction

The *Minerals Appendix* contains a discussion of coal bed natural gas (CBNG) in the planning area, conventional oil and gas production trends, the Reasonably Foreseeable Development Scenario (RFD), and a description of the cumulative effects projects evaluated for this study.

Coal Bed Natural Gas

CBNG is a product of the transformation of plant material into coal; large volumes of methane are produced as coal matures due to heat of burial and the action of naturally occurring microbes. This methane-rich gas is adsorbed and stored on internal surfaces within the coal. The pressure of fluids (mostly formation water) in the coal reservoir keeps the methane adsorbed onto the coal. When meteoric waters encounter the methane-rich coals, bacteria act upon the coals and their entrained fluids to produce more methane (PTTC 2000). This biogenic methane-rich gas is also adsorbed onto the coal surfaces. Thermogenic methane can be differentiated from biogenic methane by the ratios of their stable carbon isotopes, that is, the ratio of C^{12} to C^{13} compared to a standard such as the PeeDee belemnite, a fossil marine mollusk (Coplen 1994). Methane with relative enrichment of C^{12} is indicative of low-temperature, biogenic gas; the heavier C^{13} isotope is enriched in the high-temperature gas. Both forms of methane have been reported in CBNG reservoirs (USGS 2000).

Coalbed gas reservoirs, because of their fine-grained nature, are able to hold six or seven times as much gas as conventional sand or carbonate reservoirs (USGS 2000), a factor that has made CBNG a desirable resource. Methane produced from coal beds is an unconventional hydrocarbon resource that has undergone rapid nationwide development in the past fifteen years (Nelson 2000). The Powder River Basin is estimated to contain approximately 39 trillion cubic feet [TCF] total gas in place (Hill et al. 2000)—approximately 10 percent of which is in Montana. The methane is contained in the Tertiary-age Fort Union Formation coal beds. Under initial reservoir conditions, the coal is under virgin hydrostatic pressure, which confines the coal and holds in the methane. Pumping water from the coal reduces hydrostatic pressure in the aquifer. The methane releases from the coal and moves through the natural cleat of the coal toward producing boreholes.

CBNG in Montana is currently produced only at the CX Ranch field in Big Horn County on the western edge of the Powder River Basin. During the first year of production, 1999, the field produced 204,433 MCF of natural gas. The subsequent year, 2000, the field produced 3.49 billion cubic feet (BCF) of natural gas (MBOGC 2001b). For 2004, the CX Ranch field produced 12.24 BCF of natural gas (MBOGC On-Line Data).

CBNG is prospective in the RMP areas that are the subject of this SEIS. In the Billings RMP area, the Bull Mountains Basin contains Fort Union Formation coals that may be similar to the Powder River Basin coals. CBNG resources are subject to the same drainage issues as conventional oil and gas resources. It is assumed that a single CBNG well will drain those resources in a single coal seam across 80 acres. Site-specific CBNG drainage may, however, be different and needs to be monitored to protect federal and Indian lands.

A study prepared at the request of Congress under a provision of the 2000 Energy Policy and Conservation Act (EPCA) was completed in 2002 by BLM, USGS, USFS, and the DOEs Office of Fossil Fuels and Energy Information Administration (EIA). The EPCA inventory, published in 2003 in both hardcopy and on CDs, provides estimates of undiscovered technically recoverable resources and proven reserves of oil and gas beneath five basins including the Powder River Basin (EPCA, 2003). The estimate of CBNG for the Powder River Basin (USGS Digital Data Series DDS-69-C, 2004) raised the technically recoverable amount of CBNG from 1.1 trillion cubic feet to 14.3 trillion cubic feet. The increase is accounted for by better data. Over the past 10 years, industry has drilled thousands of new wells, and information from these wells has provide a much better geologic definition of the unconventional oil and gas plays in the basin. In 1995 there were only two or three coal beds that were generating gas; but by 2004 it was found that other, deeper coal bed seams were generating more gas (ibid). The coal beds where CBNG is being produced in the Powder River Basin contain low-rank coal.

Of the 14.3 TCF estimated recoverable CBNG, the USGS estimates 5.0 TCF in Montana and 9.3 TCF in the Wyoming portion of the PRB.

In preparing this SEIS/Amendment, the updated EPCA estimate was considered for evaluation and alteration of the RFD. However, upon recognition of the original method used to estimate the reasonable foreseeable

development, it was noted that all possible CBNG wells over the next 20 years were accounted for, based on gas quantity per ton of coal present and potential drainage spacing. Therefore, considering the spacing (1 well/80-acre/coal seam), and the duration of the well life, it was felt that all known coal with the potential for CBNG production was accounted for and thus the gas present could be reached and extracted. No revision to the original number of CBNG wells predicted is necessary or was made.

Furthermore, the federal coal beneath the Custer National Forest was considered in the original RFD, and the EPCA estimate did not provide any new information with regards to the potential leasing or development of CBNG on the forest. Therefore, the original estimate for the Custer National Forest was not revised. Additionally the Ashland Ranger District has not completed an official RFD for the Custer National Forest nor has there been a leasing EIS proposed or scheduled for these minerals. Therefore, the existing estimate is adequate for the foreseeable future.

Conventional Oil and Gas Production Trends

Montana's oil production for 1999 was down by approximately 8 percent (from 16.61 million barrels of oil [mmbo] to 15.27 mmbo) from 1998. The oil production trend has been in place since 1984 when oil production began to decrease because of commodity prices. Due to increases in commodity prices, the rapid expansion of horizontal drilling, and improvements in secondary and tertiary recovery techniques, this downward trend started to reverse itself in 2000, and by the end of 2004 production had increased to 24.7 mmbo. Natural gas production increased by approximately 3 percent (59.7 BCF to 61.6 BCF) during 1998. Natural gas production has shown gradual increases in yearly production with an annual production for 2004 of 97.96 BCF (MBOGC On-Line Data). Drilling within the state for conventional oil and gas increased by approximately 55 percent from 1998 to 1999. Conventional oil and gas activity increased by approximately 27.2 percent from 2003 to 2004. Horizontal well completions continue to be popular in the state. In 1999, the Montana Board of Oil and Gas Conservation (MBOGC) gave approval for seven new horizontal wells and two horizontal re-completions of existing vertical wells. For 2004, the MBOGC approved 205 horizontal wells and 48 horizontal recompletions of existing vertical wells. In 1999, BLM approved four new horizontal wells and one horizontal recompletion. In 2000, BLM approved 13 new horizontal wells and 16 recompletions. In 2004, BLM approved 35 new horizontal wells and 36 recompletions as horizontal wells.

Figures MIN-1 and MIN-2 were constructed using the latest data available from the production files of the MBOGC.

Figure MIN-1

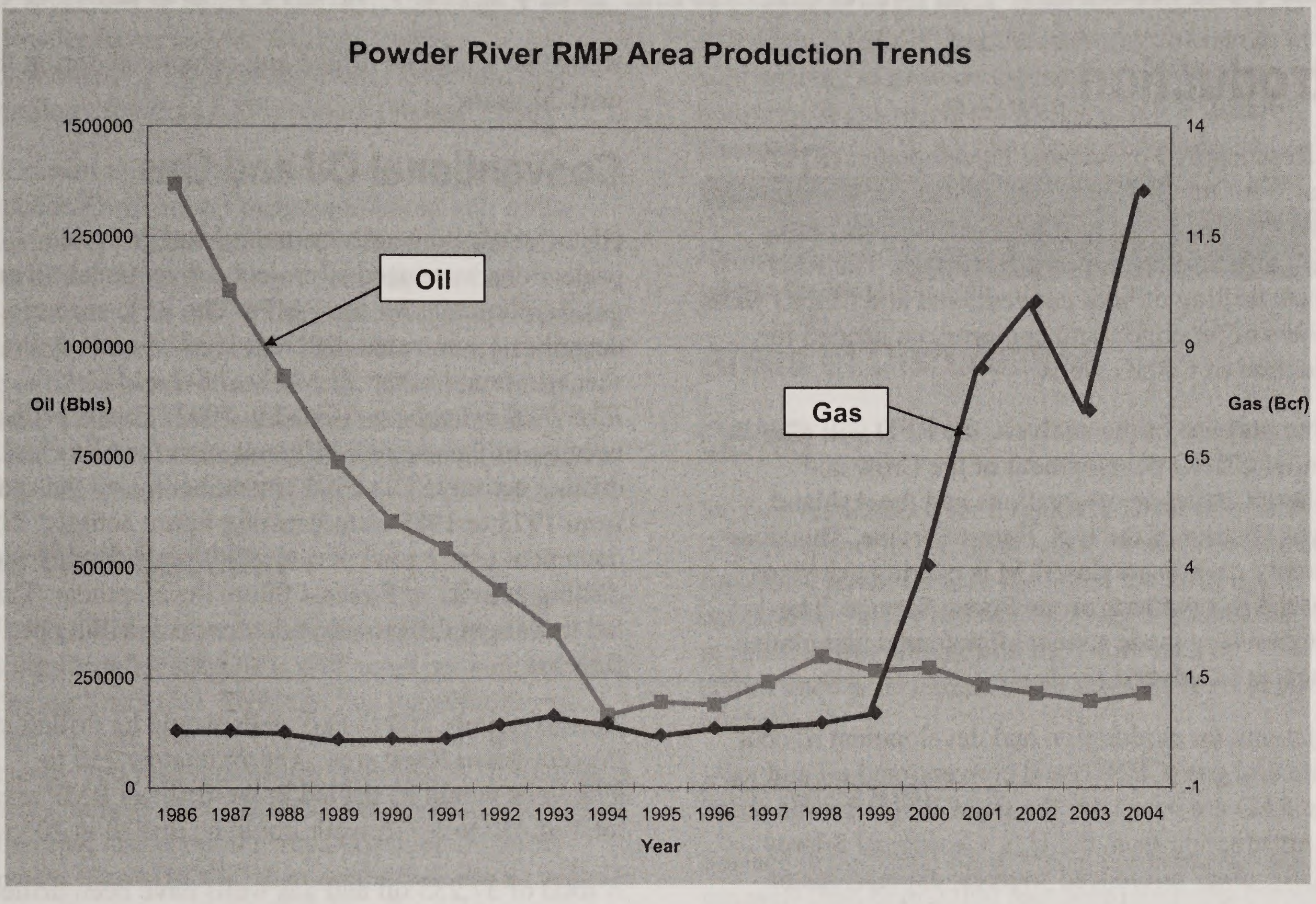
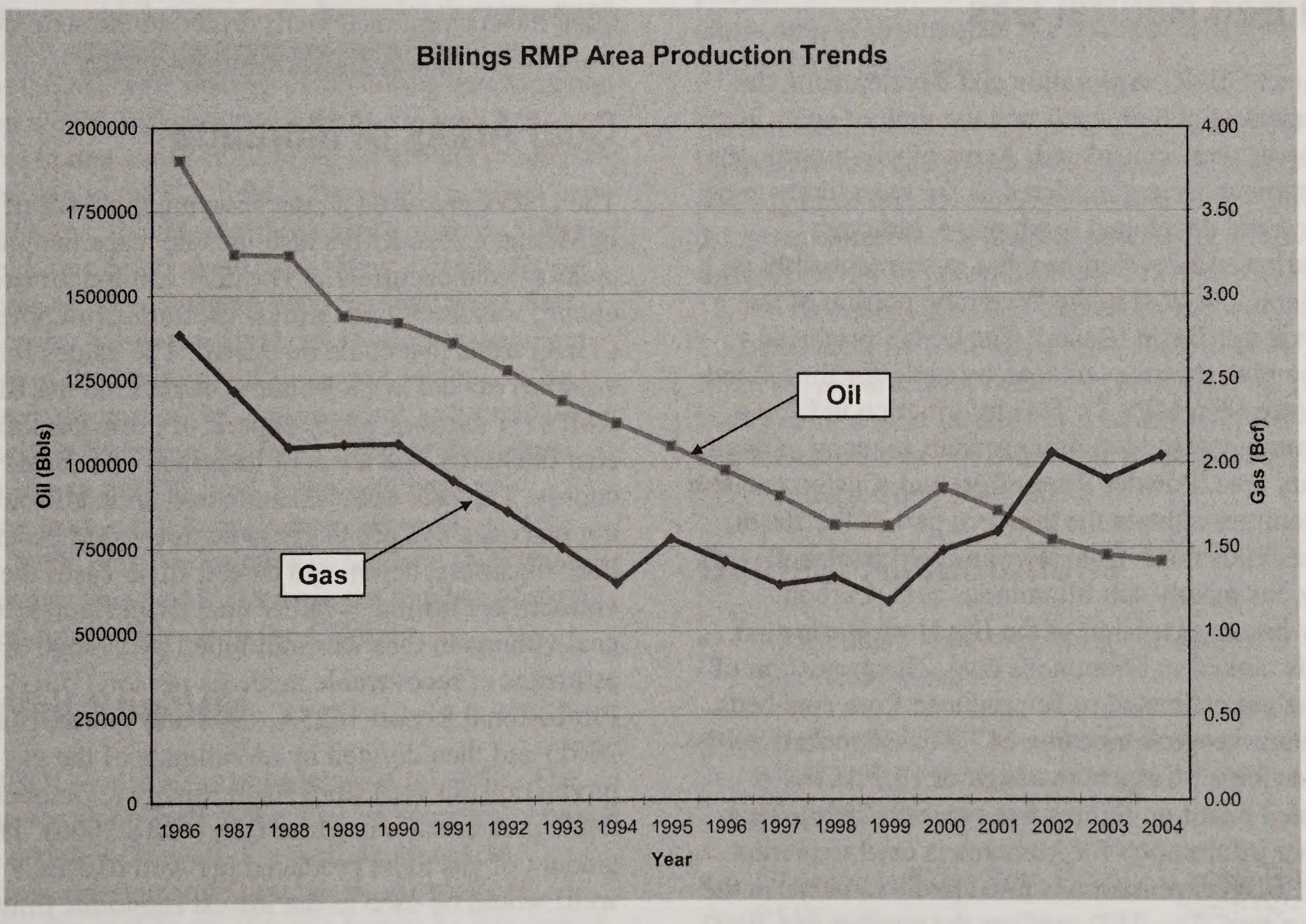


Figure MIN-2



REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

Introduction

The Reasonably Foreseeable Development (RFD) scenario for the SEIS predicts oil and gas development for the Powder River Resource Management Plan (RMP) area and the Billings RMP area. The RFD projects drilling of both conventional and CBNG wells, numbers of pipelines, and compressors needed for production of CBNG wells.

For the purpose of the analysis, the RFD will address potential CBNG development of the Crow and Northern Cheyenne reservations and the Ashland Ranger District of the U.S. Forest Service. This does not imply or indicate the BLM is making decisions about the reservations or the Forest Service. The predictions are made so that all potential cumulative impacts are analyzed.

Predictions for exploration and development of coal bed natural gas (CBNG) and conventional oil and gas in the RFD are based on: the BLM RMPs for the areas; coal information from the U.S. Geological Survey (USGS); other referenced sources; expressions of interest; and projections from the oil and gas industry (Oct 18, 2000, CBNG Coordination meeting).

Coal Bed Natural Gas

To project CBNG exploration and development, the areal extent of certain coals and the rank of coals in the study areas were considered. Areas of sub-bituminous to bituminous were considered as the most likely to be explored and developed in Montana, although exploration and development has occurred mainly in sub-bituminous coal in the Wyoming portion of the Powder River Basin (Basin). The USGS produced a map showing the areas of coal, by rank, for the United States (see Map MIN-1). This information indicates sub-bituminous and bituminous coals in many parts of the study area. Powder River, Rosebud, Custer, and Big Horn counties contain the northern part of the Basin, which extends north from Wyoming. Musselshell County has mostly sub-bituminous coal. Carbon County has an extension of the Big Horn Basin coal, which is ranked as bituminous coal. The projection of methane gas estimated to be produced from coal beds in Montana range from a low of 1 TCF (Crockett 2001-PRB est -RMG, Casper) to a high of 17.7 TCF (estimated based on figures from Nelson 2000). This and other information for Montana is used to predict where CBNG exploration is most likely to occur in the planning area. The RFD predicts the number of CBNG wells that would be drilled and completed during the next 20 years.

Conventional Oil and Gas

Historical drilling activity and oil and gas price projections were used to project conventional oil and gas development for the RMPs. The RFD scenario describes a somewhat different level of activity than the scenario found in the BLM *Final Oil and Gas RMP/EIS Amendment* issued in 1992. This is primarily because of the use of a different span for historical drilling activity. The 1992 amendment used the span from 1973 to 1988 in forecasting future activity. This document uses a total period of 80 years for historical drilling activity to forecast future development. This led to a slight difference in the level of drilling activity forecast.

Approximately 200 to 800 wells would be drilled in the Powder River RMP area. Approximately 250 to 975 wells would be drilled in the Billings RMP area. A total of 450 to 1,775 wells could be drilled in 20 years.

A total of 37,233 oil and gas wells have been drilled in Montana as of the 2003 FEIS (Petroleum Information Corp, 2001). This is an average of approximately 450 wells drilled per year statewide. From 1995 through 2004 the conventional wells drilled in the state ranged from 209 to 565 (MBOGC On-Line Data).

Coal Areas of Montana

The USGS produced a map showing the areas of coal in Montana. The RMPs also include maps that indicate areas of coal occurrence. The coal volume for each county was used to determine the number of potential CBNG wells that could be drilled. The values for volumes of coal in each county came from the BLM RMPs for the area, study papers, or estimates based on coal thickness, and acres of identified coal fields in the county. The coal volumes are based upon all coal beds, not just ones that are likely to be developed because of their thickness, depth, and extent. In all cases the volumes are estimates rather than exact figures. The coal volume in tons was multiplied by a range of estimates of recoverable methane per ton (USGS Professional Report 1625A, 1998 and Flores, et al. 2001) and then divided by an estimate of the gas production per well from CMS Energy's, October 18, 2000, presentation in Miles City (CMS 2000). The amount of gas to be produced per well (0.3 BCF per well) would be used as the lowest economic limit. This

resulted in a range of wells that may be drilled over the next 20 years. The coal volume data came mostly from the Powder River and the Billings RMPs, supplemented by information from USGS and Gas Technology Institute (GTI) papers (Nelson 2000).

Coal resources in the Powder River Basin are in the Paleocene Fort Union Formation. About half of the estimated 39 trillion cubic feet of in-place CBNG resource is recoverable. Less than half the coal resources occur in the Montana portion of the Basin. These sub-bituminous coals have low concentrations of gas per unit volume (Choate et al. 1984). However, because of the immense total coal thickness that reaches 170 feet in some areas in Montana (Campen 1990), vast quantities of CBNG may be present.

Gas Well Spacing

The MBOGC establishes the spacing of gas wells. Spacing for wildcat wells is 640 acres per well for each producing formation. MBOGC has the authority to change the well spacing to provide for maximum efficiency and recovery of gas reserves. Well spacing is usually changed after MBOGC has reviewed geologic, engineering and economic data provided by lease operators. The MBOGC then establishes the boundaries for a producing gas field. The planning area includes only one CBNG field and numerous conventional gas fields. When a field is discovered, the exploration company would appear before MBOGC to request permanent spacing for the production. Based upon current CBNG well spacing in Wyoming and Montana, spacing would probably range from one well per 80 acres to one well per 40 acres for CBNG production. The spacing in the CX field is four wells per coal bed per 160 acres. Because of the number of coals in the CX field, this could result in as many as 16 wells per 160 acres or potentially 64 wells per 640 acres. The well density has not reached this level at present and because of the faulting, splitting, and joining of the coals and absence of the coals in some sections this is not likely to happen. CBNG is produced from three coal seams in the CX field. Each well produces methane from a single coal seam; however, in the future, wells may be designed to produce from multiple coal seams. This would decrease the number of wells required for production in the CX field.

Oil Well Spacing

The MBOGC also sets the spacing of oil wells. The spacing for an oil well in the state of Montana is based on the depth of the well. For well depth of 0 to 6,000 feet, the statewide spacing is one well per 40 acres; for well depth of 6,001 feet to 11,000 feet, it would be one well per 160 acres; finally, for well depth of more than 11,001 feet, it would be one well per 320 acres. MBOGC has the authority to change the well spacing to provide for maximum efficiency and recovery of gas reserves. Well spacing is usually changed after MBOGC has reviewed geologic, engineering, and economic data provided by lease operators. The MBOGC then establishes the boundaries for the producing oil field. There are numerous fields within the planning area.

Areas of Disturbance

CBNG

Surface disturbance for a typical CBNG well includes 0.25 acres for the well pad and 0.75 acres for the access road for a total of 1 acre disturbed for drilling operations. Part of the well pad area is reclaimed for production operations, and the entire area of disturbance is reclaimed when the well is plugged and abandoned.

Conventional

Surface disturbance for a typical conventional shallow gas well (less than 2,000 feet deep) includes 0.5 acres for the well pad and a 2-mile bladed road for a total of 1 acre disturbed for drilling operations. Part of the well pad area is reclaimed for production operations, and the entire area of disturbance is reclaimed when the well is plugged and abandoned.

Surface disturbance for a typical shallow oil well (less than 5,000 feet deep) includes 2 acres for the well pad and 1.5 acres for a 1-mile bladed road for a total of 3.5 acres disturbed for drilling operations. Surface disturbance for a typical deep oil well (from 5,000 to 12,000 feet deep) includes 4 acres for the well pad and 1.5 acres for a 1-mile bladed road, for a total of 5.5 acres disturbed for drilling operations. Part of the well pad area is reclaimed for production operations, and the entire area of disturbance is reclaimed when the well is plugged and abandoned.

General Assumptions

- All numbers were rounded to the nearest significant number.
- The number of BLM-administered wells will be based on the BLM-administered oil and gas acreage in the county.
- 80 percent of Big Horn County is in the Billings RMP area.

Occurrence Potential

The text in this section discusses the oil and gas occurrence potential for each county.

Big Horn County

CBNG

The southeastern and eastern portion of the county contains approximately 28,700 million tons of sub-bituminous coal (Powder River RMP). The area includes one CBNG field (CX Ranch).

Conventional

The county has nine oil and gas fields, including four oil fields, one conventional gas field at Toluca, and an inactive gas field at Hardin. The oil and gas fields in Big Horn County produce from the Ft. Union, Shannon, Amsden, Madison, and Tensleep formations. Production has occurred from the Frontier formation (Hardin Gas field). A total of 844 wells have been drilled to date, of which 172 have been drilled on the Crow Reservation. One gas sales line runs through the north portion of Big Horn County, but none on the Crow Reservation.

Carbon County

CBNG

Carbon County includes the Silvertip, Bear Creek, Bridger and the Joliet-Fromberg coal fields. The coal ranges from Ft Union to Eagle coal and is of sub-bituminous to bituminous nature. The volume of coal is estimated at approximately 760 million tons. The estimate of the gas content of the coals for sub-bituminous will be the same as the coals in the Powder River basin. The estimate for the bituminous coals for the RFD will be from 200 to 450 standard cubic feet (SCF)/ton.

Conventional

Carbon County includes 18 identified gas and oil fields. The wells produce from the Frontier, Phosporia-Tensleep, Judith River, Claggett, Eagle, and Greybull formations. A total 735 wells have been drilled to date in this county (Dwights well data).

Carter County

CBNG

Bituminous or sub-bituminous coals have not been identified in Carter County. The only coal is of lignite rank, which is not considered to have a potential to produce methane in economic quantities.

Conventional

Carter County includes the Bell Creek, Southeast Bell Creek, and Repeat oil fields, as well as two gas fields near Hammond. They produce from the Muddy and Red River formations. There have been 434 wells drilled to date in this county.

Custer County

CBNG

The Powder River RMP estimated 1.3 billion tons of sub-bituminous coal is located within Custer County. The coal occurs in the southern and southwestern portion of the county.

Conventional

The Liscom Creek and Pumpkin Creek fields are located in Custer County. Gas in these fields is produced from the Shannon formation. These fields have a small sales line in place.

Golden Valley County

CBNG

Although there is some coal shown for Golden Valley County, there are no volumes estimated. The coal that is shown is of the sub-bituminous rank.

Conventional

Two oil and two gas fields have been identified in this county, and 124 wells have been drilled to date. The wells have produced from the Cat Creek, Lakota, Niobrara, Frontier, Heath, and Tyler formations.

Musselshell County

CBNG

The RMP estimated 646.6 million tons of sub-bituminous coal in the county. These Ft. Union coals are located in the Bull Mountain Basin.

Conventional

Thirty-five fields have been identified in Musselshell County, and 1,415 wells have been drilled to date. The wells have produced from the Amsden, Cat Creek, Morrison, Heath, and Tyler formations.

Powder River County

CBNG

Based on information from the RMP, there are 27 billion tons of sub-bituminous coal in the county. The coal is located mostly in the western half of the county.

Conventional

The county has seven oil and gas fields, including Bell Creek, which is the second-largest producing field in Montana (based on cumulative production). The Shannon and Muddy formations are productive in the county, and 1,249 wells have been drilled to date.

Rosebud County

CBNG

Rosebud County contains 11.3 billion tons of sub-bituminous coal. The coal is located in the southern and eastern portion of the county.

Conventional

Rosebud County has 18 identified oil and gas fields producing from the Tyler formation, and 1,147 wells have been drilled to date.

Stillwater County

CBNG

There is one identified bituminous coal field (Stillwater) in the county and it is estimated to have 475 million tons of Eagle formation coal. The coal is estimated to contain a much higher gas content per ton than the Powder River sub-bituminous coals. The county has three gas transmission lines running through the north half of the county.

Conventional

The county has 11 identified oil and gas fields. The producing formations are the Frontier, Eagle, Claggett, Cat Creek, Morrison, and Virgelle. There have been 367 conventional wells drilled to date in the county.

Sweet Grass County

CBNG

There are no known coal reserves in the county. However, there are gas transmission lines through the center and running southeast and northeast in the county.

Conventional

One identified field—a six-shooter dome—is in Sweet Grass County. This is the Sixshooter Dome. The productive formations in the county are the Eagle and Lakota. There have been 82 conventional wells drilled to date.

Treasure County

CBNG

The RMP's coal estimates for the county from the RMP are 100 million tons. A gas transmission line runs through the southeastern part of the county.

Conventional

There are no identified oil and gas fields in the county and no productive formations have been identified; however, 32 conventional wells have been drilled to date.

Wheatland County

CBNG

No coal has been identified in Wheatland County. A gas transmission line runs through the eastern part of the county.

Conventional

One oil and gas field—Mud Creek—has been identified in the county. The Amsden formation is

productive, and 60 conventional wells have been drilled to date in the county.

Yellowstone County

CBNG

Some 590 million tons of coal have been identified in the county. There are four gas transmission lines in the southern part of the county.

Conventional

Six oil and gas fields are identified in the county, and 425 conventional wells have been drilled to date. The productive formations that have been identified are the Mosser Sand, Amsden, and Dakota.

Reasonably Foreseeable Future Actions

Reasonably Foreseeable Future Actions (RFFA) address the potential developments that may occur within other jurisdictions that fall within the Billings and Powder River resource management areas. The same general assumptions and source data used for developing the RFD are applicable.

Crow Reservation

CBNG

There has been 16.1 billion tons of coal identified on the Crow Reservation.

Conventional

The reservation includes the Soap Creek, Lodge Grass, Gray Blanket, and Ash Creek oil and gas fields. There have been 172 conventional wells drilled to date on the reservation. Production occurs from the Shannon, Tensleep, Amsden and Madison formations within the reservation.

Northern Cheyenne Reservation

CBNG

Based upon limited data, it is estimated that 16.3 billion tons of sub-bituminous coal lie within the reservation. The coal is believed to underlie most or all of the reservation.

Conventional

The reservation does not have any known oil or gas fields. Twenty conventional wells have been drilled to date.

Ashland District, U.S. Forest Service

CBNG

Tertiary Ft. Union coal is believed to underlie most or all of the Ashland Forest.

REASONABLY FORESEEABLE DEVELOPMENT—ALTERNATIVE A

CBNG

A general assumption used for this alternative for CBNG wells is that the number of townships of potential development in each county would be limited to areas where coal has been identified. Additionally, other assumptions were used for Alternative A for CBNG wells. These include:

- CBNG drilling would only be allowed where there was a need for additional data (townships where no CBNG wells had been drilled by any company).
- CBNG drilling would occur but there would be no production (from federal wells). That is, the permits would be for drilling and production testing but no commercial production (with associated infrastructure).
- No permanent pipelines, power-lines, or any production facilities would be installed at any of the federal CBNG wells.
- There would be no discharge of produced water allowed from any of the federal CBNG wells.
- For a high number, four wells per township were assumed; for the low number, one well per township was assumed.
- It was assumed that the number of townships in each county would be limited to areas where coal has been identified.

BLM-Administered

An estimated 400 acres based on 400 CBNG wells would be disturbed during exploratory drilling operations (0.25 acre per location and 0.75 acre per access road) which is the number of wells predicted to be drilled during the 20-year analysis period. The total number of acres could be reduced if more than one methane well is drilled on the well pad—as is the pattern in the CX Field.

State-Administered

Existing Management Assumptions

There will be 325 CBNG wells permitted for the Redstone project area in Big Horn County. Of these, only 250 will be allowed to produce and 75 will be for exploration only. Two hundred CBNG exploration wells will be permitted for the rest of the state.

Conventional Oil and Gas

The RFD scenario from the *Oil and Gas Amendment* contains projections for the number of wells and acres disturbed in each producing region. The disturbance for each well is based on the typical depth of wells for an area. Shallow wells generally disturb fewer acres. Tables 4.1 through 4.4 in the *Oil and Gas Amendment* show totals for the planning area and each resource area. The assumptions for conventional oil and gas in this alternative are as follows:

- The unconstrained number of wells comes from the Oil and Gas Amendment RFD scenario.
- The constrained number of wells is derived from the resource analysis for wells foregone in No Surface Occupancy areas.
- The average acreage figure (total acres/total wells) for the resource area was used to estimate federal acres disturbed.
- The RFD projections have a 20-year life.
- A more detailed description of information for the assumptions is contained in the *Oil and Gas Amendment* in *Chapter 4, Social Economic Conditions* (BLM 1992), and in *Appendix C.*

BLM-Administered

The number of acres disturbed during drilling operations would be 1,342 acres based on 400 wells, which is the number of wells predicted to be drilled during the 20-year analysis period.

State of Montana

The number of acres disturbed during drilling operations would be 4,551 acres based on 891 new wells predicted for the 20-year analysis period in the Powder River and Billings RMP areas. The RFD for the State of Montana for conventional wells under this alternative is the same as Alternatives B, C, D, E, F, G and H.

Development Potential

The development potential for federal oil and gas in each county is described in the text that follows.

Big Horn County

CBNG

Based on the review of unexplored coal areas in Big Horn County, there would be 20 to 64 exploration wells drilled on minerals under BLM jurisdiction. Approximately 16 to 44 of these wells would have production potential and 4 to 20 wells would be drilled and abandoned. The only disturbance would be for the access road and well pad.

Conventional

The county has potential for five to 30 additional wells to be drilled on minerals under BLM jurisdiction in the next 20 years, based on historical drilling rates.

Carbon County

CBNG

Based on the unexplored coal areas in the county, the BLM could permit the drilling of approximately 24 to 72 wells under this alternative. Sixteen to 48 of these wells would have the potential to be productive, and 8 to 24 wells will be drilled and abandoned. There would be no pipelines or production facilities for these wells. The only disturbance would be for the access road and well pad.

Conventional

Carbon County has potential for 10 to 45 additional wells to be drilled on minerals under BLM jurisdiction in the next 20 years, based on historical drilling rates.

Carter County

CBNG

No CBNG wells are projected to be drilled under this alternative in the county.

Conventional

The county has potential for 1 to 6 additional wells to be drilled on minerals under BLM jurisdiction in the next 20 years, based on historical drilling rates.

Custer County

CBNG

Based on the unexplored coal areas in the county, the BLM could permit the drilling of from 20 to 64 wells under this alternative. Sixteen to 44 of these wells would have the potential to be productive; and four to 20 wells will be drilled and abandoned. There would be no pipelines or production facilities for these wells. The only disturbance would be for the access road and well pad.

Conventional

The county has potential for one to three additional wells to be drilled on minerals under BLM jurisdiction in the next 20 years, based on historical drilling rates.

Golden Valley County

CBNG

No CBNG wells are projected to be drilled in this county on minerals under BLM jurisdiction with this alternative.

Conventional

The county has potential for one to six additional wells to be drilled on minerals under BLM jurisdiction in the next 20 years, based on historical drilling rates.

Musselshell County

CBNG

Based on the unexplored coal areas in the county, the BLM could permit the drilling of 10 to 40 wells under this alternative. From eight to 30 of these wells would have the potential to be productive, and two to 10 wells will be drilled and abandoned. There would be no pipelines or production facilities for these wells. The only disturbance would be for the access road and well pad.

Conventional

The county has potential for 20 to 90 additional wells to be drilled on minerals under BLM jurisdiction in the next 20 years, based on historical drilling rates.

Powder River County

CBNG

Based on the unexplored coal areas in the county, the BLM could permit the drilling of from 20 to 80 wells under this alternative. Sixteen to 60 of these wells would have the potential to be productive, and four to 20 wells will be drilled and abandoned. There would be no pipelines or production facilities for these wells. The only disturbance would be for the access road and well pad.

Conventional

The county has potential for one to three additional wells to be drilled on minerals under BLM jurisdiction in the next 20 years, based on historical drilling rates.

Rosebud County

CBNG

Based on the unexplored coal areas in the county, the BLM could permit the drilling of 12 to 48 wells under this alternative. Eight to 32 of these wells would have the potential to be productive, and four to 16 wells will be drilled and abandoned. There would be no pipelines or production facilities for these wells. The only disturbance would be for the access road and well pad.

Conventional

The county has potential for 10 to 40 additional wells to be drilled on minerals under BLM jurisdiction in the next 20 years, based on historical drilling rates.

Stillwater County

CBNG

Based on the unexplored coal areas in the county, the BLM could permit the drilling of six to 24 wells under this alternative. Four to 18 of these wells would have the potential to be productive, and two to six wells will be drilled and abandoned. There would be no pipelines or production facilities for these wells. The only disturbance would be for the access road and well pad.

Conventional

The county has potential for three to 12 additional wells to be drilled on minerals under BLM jurisdiction in the next 20 years, based on historical drilling rates.

Sweet Grass County

CBNG

Based on the lack of known coal reserves in the county, no CBNG wells are expected under this alternative.

Conventional

The county has potential for one to six additional wells to be drilled on minerals under BLM jurisdiction in the next 20 years, based on historical drilling rates.

Treasure County

CBNG

Based on the unexplored coal areas in Treasure County, the BLM could permit the drilling of two to four wells under this alternative. Up to two of these wells would have the potential to be productive, and up to two wells will be drilled and abandoned. There would be no pipelines or production facilities for these wells. The only disturbance would be for the access road and well pad.

Conventional

The county has potential for one to three additional wells to be drilled on minerals under BLM jurisdiction in the next 20 years, based on historical drilling rates.

Wheatland County

CBNG

There are no CBNG wells projected to be drilled on minerals under BLM jurisdiction in the county.

Conventional

The county has potential for one to three additional wells to be drilled on minerals under BLM jurisdiction in the next 20 years, based on historical drilling rates.

Yellowstone County

CBNG

Based on the unexplored coal areas in the county, the BLM could permit the drilling of two to six wells under this alternative. Up to three of these wells would have the potential to be productive, and up to three wells will be drilled and abandoned. There would be no pipelines

or production facilities for these wells. The only disturbance would be for the access road and well pad.

Conventional

The county has potential for five to 15 additional wells to be drilled on minerals under BLM jurisdiction in the next 20 years, based on historical drilling rates.

RFD Conclusion

CBNG

During the life of the plan, it is estimated that the number of CBNG exploration wells that may be drilled throughout the two RMP areas would range from a low of 110 wells to a high of 400 wells on BLM-administered minerals. CBNG drilling would be allowed but there would be no production (from federal wells). This means the permits would be for drilling and testing but no production. There would be no pipelines or power-lines or any production facilities installed at any of the federal CBNG wells. There would be no discharge of produced water allowed from any of the federal CBNG wells. This would result in approximately 400 acres of disturbance for the 400 wells (0.25 acre/location and 0.75 acre/access road).

State development under this scenario would include previously approved CBNG wells at the CX Ranch and additional exploration wells. The CX Ranch could drill up to 325 wells, of which 250 could be developed for production. An additional 200 exploration well permits would be issued to operators to investigate the likelihood of CBNG development throughout the state.

Powder River RMP Area

During the life of the plan, it is estimated that the number of CBNG wells that may be drilled in the Powder River RMP area would range from a low of 60 wells to a high of 240 wells on BLM-administered minerals. CBNG drilling would be allowed but there would be no production (from federal wells). This means the permits would be for drilling and testing but no production. There would be no pipelines or power-lines or any production facilities installed at any of the federal CBNG wells. There would be no discharge of produced water allowed from any of the federal CBNG wells. This would result in approximately 240 acres of disturbance for the 240 wells (0.25 acre/location and 0.75 acre/access road).

Billings RMP Area

During the life of the plan, it is estimated that the number of CBNG wells that may be drilled throughout the Billings RMP area would range from a low of 50 wells to a high of 160 wells on BLM-administered minerals. CBNG drilling would be allowed but there would be no production from Federal wells. This means the permits would be for drilling and testing but no production. There would be no pipelines, power-lines, or any production facilities installed at any of the federal CBNG wells. There would be no discharge of produced water allowed from any of the federal CBNG wells. This would result in approximately 160 acres of disturbance for the 160 wells (0.25 acre/location and 0.75 acre/access road).

Conventional Oil and Gas

Based on the Assumptions listed at the beginning of this section, the number of conventional oil and gas wells that could be drilled on BLM administered minerals would range from a low of 60 to a high of 260 wells. No estimates of disturbance were made for conventional wells.

Powder River RMP Area

The RFD estimates that 15 to 60 of these wells would be drilled on minerals under BLM jurisdiction. Most of these wells would be drilled in or near the existing fields.

Billings RMP Area

The RFD estimates that 45 to 200 conventional wells are to be drilled on minerals under BLM jurisdiction. Most of these wells would be drilled in or near the existing fields.

Reasonably Foreseeable Future Actions—Alternative A

The RFFA predictions for Alternative A were developed using the same general assumptions as the RFD.

Forest Service—Administered

Currently, the Custer National Forest, Ashland Ranger District, is not open for oil and gas leasing. Alternative

A assumes that similar management would continue, no leases would be issued, and no wells drilled.

Crow Reservation

CBNG

Although there is a considerable amount of known coal reserves on the reservation, it is assumed that the Crow Tribe of Indians would not develop any CBNG under this alternative.

Conventional

The Reservation has potential fourteen to twenty additional wells to be drilled on Tribal minerals in the next 20 years, based on historical drilling rates.

Northern Cheyenne Reservation

CBNG

Although there is a considerable amount of known coal reserves on the reservation, it is assumed that the Northern Cheyenne Tribe would not develop any CBNG under this alternative.

Conventional

Based on historical drilling rates it would appear that no conventional oil or gas wells would be developed on the reservation under this alternative.

REASONABLY FORESEEABLE DEVELOPMENT—Alternatives B, C, D, E, F, G and H

Assumptions

CBNG

The following assumptions were used to calculate the number of wells to be drilled, the number of in-field compressors, and the number of sales compressors required:

- The coal volume for each county was taken from published sources such as the RMPs. For the RMPs, all tonnages are based on in-place coal with development potential defined as beds 5 feet thick or greater, with a 15:l or less stripping ratio, and 500 feet of overburden or less. This gives a greater tonnage than actual limits currently used by the mining industry in the area, where stripping limits seldom exceed 200 feet of overburden or a ratio of 6:l. Tonnage calculations are based on 1,770 tons/acre-foot. For the Northern Cheyenne Reservation, the coal volumes from the USGS and U.S. Bureau of Mines reports are based on very limited data. The coal volumes for the Crow Reservation from the USGS and U.S. Bureau of Mines report were based on more extensive data. The coal tonnages in the RMPs include strippable coal, which may or may not contain producible methane in economic quantities
- The gas content per ton used to calculate the quantity of gas from sub-bituminous coal was 74 standard cubic feet per ton (SCF/ton) and came from studies by the USGS (Professional Paper 1625-A). The gas content for bituminous coal used to calculate the quantity was (450 SCF/ton) and came from a paper by Campen and Gruber (1991).
- The spacing for the CBNG wells would be one well per 80 acres per coal seam. The spacing was assumed after discussions with the MBOGC, as well as our understanding that Wyoming will be using this spacing (as a general rule) for CBNG wells.
- Three coal seams would be developed per 80 acres. Another way of saying this is there would be three wells per pad in each 80 acres.
- One field compressor would service 24 CBNG wells. The area of disturbance would be 0.5 acres.
- One sales compressor could handle 10 field compressors. The area of disturbance would be 0.5 acres.
- Each CBNG well would produce .3 BCF of gas.
- Where the wells would be located in the counties was based on either the Montana Coal Occurrences from the USGS open file report OF 96-92, the RMPs, or information from the U.S. Bureau of Indian Affairs (BIA).
- No predictions were made based on distances to coal outcrops, thickness of individual coal seams, or thickness of overburden to coals. This information will be used by companies to place individual wells.
- The coal in each county did not include the coal on the Indian reservation in that specific county. The coal (from USGS and U.S. Bureau of Mines reports) on each Indian reservation resulted in a number of wells being drilled on each reservation.
- The RFD assumed that areas of lignite would not have economic production of methane so no wells were forecasted in those areas. We are not aware of any companies or individuals that are currently pursuing the testing of lignite for gas. With the present technology, it is unlikely that industry will be able to produce commercial amounts of gas from lignite within Montana, for the reasonably foreseeable future.
- The number of CBNG producing wells in each county would be approximately 90 percent of the total CBNG wells projected for that county.
- The number of CBNG dry holes would be approximately 10 percent of the total CBNG wells projected for that county.
- A 0.5-mile gathering line would be buried from the CBNG well to the field compressor. The width of disturbance would be 15 feet. Multiple flowlines would be laid in the same trench from a well pad with more than one CBNG well. Whenever possible, these lines would be placed in the access road to the wells. This would result in 0.9 acres of disturbance per line.
- There would then be steel lines going from each gathering field compressor to the sales compressor.

There would be 2 miles of these steel lines per field compressor. The width of disturbance would be 25 feet. This would result in 6 acres of disturbance per line.

- The lines would go from the sales compressor to the sales lines. These would be high-pressure steel lines. There would be no more than 60 miles of these high-pressure steel lines per county. The width of disturbance would be 25 feet. This would result in 3 acres of disturbance per mile of sales line.
- The estimates for CBNG wells did not take into account variations in topography, which could have a significant impact to actual placement and numbers of wells.
- The rate of development for 20 years was based on the industry projection of October 18, 2000. The projected rate is shown in Figure MIN-4. The rate of abandonment is presented in Figure MIN-5 for the expanded development alternatives and in Figure MIN-6 for the phased development alternatives.
- For purposes of planning, the State of Montana would consider other counties, such as Blaine, Gallatin, or Park, which may have coal resources.

Conventional Wells

- Wells drilled to date in each county were taken from Dwights well data.
- The number of wells drilled to date was divided by 80 years, which is an approximation of how long exploration has been ongoing.
  - This number was multiplied by one quarter (.25), then multiplied by 20 years for the low estimate of drilling for the next 20 years.
  - The number was multiplied by 20 years to calculate a high level of drilling for the next 20 years.
- The wells drilled on each reservation were counted in the total for each county.
- The percentage of dry holes for each county is based on the overall historical percentage of non-producing wells (71 percent), compared to the total wells drilled per county.
- The acres disturbed per well will be the same as shown in alternative A.

Development Potential

The development potential for CBNG and conventional wells for all owners is described in the text that follows.

Big Horn County

CBNG

Based on the volume of coal in these areas, Big Horn County could support from 2,500 to 7,000 CBNG wells. Approximately, half of these wells (1,250 to 3,500) would be drilled on minerals under BLM jurisdiction. Producing CBNG wells would range from 2,200 to 6,300 wells. Most of the wells in Big Horn County would be in the southeastern portion of the county. There would be from 100 to 250 field compressors. The number of sales compressors estimated for Big Horn County would be from 10 to 25. This level of production would require gathering and sales lines to be constructed. From 1,450 to 4,200 miles of plastic, low-pressure gathering lines would be needed. These lines would be laid in the travel routes to the wells and follow the roads to the field compressors. From 200 to 500 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors. No more than 60 miles of sales lines would be laid to the main transmission lines. The sales lines would probably go north toward the main WBI pipeline or south to main lines in Wyoming.

Conventional

The county has potential for 50 to 200 additional wells to be drilled in the next 20 years, based on historical drilling rates. From 3 to 15 of these wells would be drilled on minerals under BLM jurisdiction.

Carbon County

CBNG

The coal in Carbon County varies from Tertiary Ft. Union (sub-bituminous) to the Cretaceous Eagle (bituminous). The Eagle coal can contain more gas per ton than the Ft. Union coals. Based on the coal volumes and gas content, 150 to 400 wells could be drilled. Thirty to 60 of these wells would be drilled on minerals under BLM jurisdiction. From 135 to 360 producing CBNG wells mostly would be located near the identified coal fields. The number of wells would require from five to 15 field compressors and one to two sales compressors. Ninety to 240 miles of plastic,

low-pressure gathering lines would be needed. These lines would be laid in the travel routes to the wells and would follow the roads to the field compressors. Ten to 30 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors. There would be no more than 60 miles of sales lines laid to the main transmission lines.

Conventional

Based on historical drilling, it is estimated that 50 to 200 wells would be drilled in the next 20 years. From 10 to 40 of these wells would be drilled on minerals under BLM jurisdiction. Some of these would be wildcat wells, but the majority would probably be associated with the existing fields.

Carter County

CBNG

CBNG wells are not predicted to be drilled in Carter County because of the nonexistence of bituminous or sub-bituminous coals.

Conventional

Based on historical drilling rates, we anticipate 25 to 100 wells to be drilled in the next 20 years. Ten to 40 of these wells would be drilled on minerals under BLM jurisdiction.

Custer County

CBNG

Based on the estimated quantity of coal, 100 to 300 wells will need to be drilled; of these, 90 to 270 would be producing wells. The CBNG development would occur in the southwestern corner of the county. Twenty to 70 of these wells would be drilled on minerals under BLM jurisdiction. This many wells would require from five to 10 field compressors and one to two sales compressors. Additional pipelines would have to be built. Sixty to 180 miles of plastic, low-pressure gathering lines would be needed. These lines would be laid in the travel routes to the wells and follow the roads to the field compressors. Ten to 20 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors. No more than 60 miles of sales lines would be laid to the main transmission lines.

Conventional

Based on historical drilling rates, we estimate from 15 to 60 wells will be drilled in the next 20 years. Five to 15 of these wells would need to be drilled on minerals under BLM jurisdiction.

Golden Valley County

CBNG

No CBNG wells are anticipated to be drilled in Golden Valley County.

Conventional

Based on historical drilling activity, it is anticipated that 10 to 30 wells would be drilled in the county over the next 20 years. Most of these will probably be near the existing fields. One or two of these wells would be drilled on minerals under BLM jurisdiction.

Musselshell County

CBNG

Based on the estimates of coal in the county, it is projected that 60 to 150 wells would be drilled, and of these, there would be from 50 to 140 producing wells. Five to 20 of these wells would be drilled on minerals under BLM jurisdiction. These wells would require from two to five in-field compressors and one sales compressor. No gas sales lines run through the county. Thirty to 100 miles of plastic, low-pressure gathering lines would be needed. These lines would be laid in the travel routes to the wells and follow the roads to the field compressors. Five to 10 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors. No more than 60 miles of sales lines would be laid to the main transmission lines.

Conventional

It is estimated that 100 to 350 wells will be drilled in the county in the next 20 years. Ten to 40 of these wells would be drilled on minerals under BLM jurisdiction.

Powder River County

CBNG

Based on the coals present in Powder River County, it is estimated that 2,300 to 6,700 CBNG wells could be drilled. From 1,150 to 3,350 of these wells would be drilled on minerals under BLM jurisdiction. There

would be 2,070 to 6,030 producing CBNG wells, which would require 100 to 250 field compressors, and 10 to 25 sales compressors. There is a transmission line in the southeastern part of the county but more pipelines would have to be built to gather and transport the potential gas that could be produced from this many wells. From 1,380 to 4,000 miles of plastic, low-pressure gathering lines would be needed. These lines would be laid in the travel routes to the wells and follow the roads to the field compressors. Two hundred to 500 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors. There would be no more than 60 miles of sales lines laid to the main transmission lines.

Conventional

Based on historical drilling rates, it is anticipated that 80 to 300 conventional wells would need to be drilled in the county over the next 20 years. Thirty to 100 of these wells would be drilled on minerals under BLM jurisdiction.

Rosebud County

CBNG

Based on the coal estimates for Rosebud County, the RFD projects 1,000 to 2,800 CBNG wells will be drilled. From 500 to 1,400 of these wells would be drilled on minerals under BLM jurisdiction. There would be from 900 to 2,500 producing CBNG wells, which would require approximately 40 to 100 field compressors and from five to 10 sales compressors. From 600 to 1650 miles of plastic, low-pressure gathering lines would be needed. These lines would be laid in the travel routes to the wells and follow the roads to the field compressors. Eighty to 200 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors, and there would be no more than 60 miles of sales lines laid to the main transmission lines. There is one gas sales line that runs through the county south of Forsyth. The CBNG development would occur in the southern and eastern half of the county.

Conventional

Based on historical drilling rates in the county, the RFD projects 50 to 300 wells to be drilled over the next 20 years. Five to 50 of these wells would be drilled on minerals under BLM jurisdiction.

Stillwater County

CBNG

The RFD projects 300 to 700 CBNG wells to be drilled in the county. Fifteen to 35 of these wells would be drilled on minerals under BLM jurisdiction. These would most likely be drilled in the vicinity of the existing coal field. From 270 to 630 would be producing CBNG wells. This would require 10 to 25 field compressors and one to three sales compressors. One hundred and eighty to 420 miles of plastic, low-pressure gathering lines would be needed. These lines would be laid in the travel routes to the wells and follow the roads to the field compressors. Twenty to 50 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors. No more than 30 miles of sales lines would be laid to the main transmission lines.

Conventional

Based on historical drilling rates, the RFD projects 25 to 100 conventional wells will be drilled in the next 20 years. Two to 5 of these wells would be drilled on minerals under BLM jurisdiction.

Sweet Grass County

CBNG

There are no known coal reserves in the county and therefore, no CBNG wells are anticipated for Sweet Grass County.

Conventional

Based on historical drilling rates, the RFD projects that five to 20 conventional wells will be drilled in the next 20 years. Up to 1 of these wells would be drilled on minerals under BLM jurisdiction.

Treasure County

CBNG

Based on the estimated coal volume in this county, the RFD projects that 10 to 25 CBNG wells could be drilled. One to 2 of these wells would be drilled on minerals under BLM jurisdiction. There would be eight to 22 producing CBNG wells, which would require 1 to 2 in-field compressors and 1 sales compressor. Five to 15 miles of plastic, low-pressure gathering lines would be needed. These lines would be laid in the travel routes to the wells and would follow the roads to the

field compressors. One to 2 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors. No more than 10 miles of sales lines would be laid to the main transmission lines.

Conventional

Based on historical drilling rates, the RFD projects one to 10 conventional wells will be drilled in the next 20 years. None of these wells would be drilled on minerals under BLM jurisdiction.

Wheatland County

CBNG

No CBNG wells are projected to be drilled in Wheatland County.

Conventional

Based on historical drilling rates, the RFD projects five to 15 conventional wells will be drilled in the next 20 years. None of these wells would be drilled on minerals under BLM jurisdiction.

Yellowstone County

CBNG

Based on the identified coal, there could be from 50 to 150 CBNG wells drilled in the next 20 years. One to 10 of these wells would be drilled on minerals under BLM jurisdiction. There would be 40 to 140 producing CBNG wells in the county, which would require from two to five field compressors and one sales compressor. Twenty five to 90 miles of plastic, low-pressure gathering lines would be needed. These lines would be laid in the travel routes to the wells and would follow the roads to the field compressors. Five to 10 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors. No more than 10 miles of sales lines would be laid to the main transmission lines.

Conventional

Based on historical drilling in the county, there could be from 25 to 100 wells drilled in the county in the next 20 years. None of these wells would be drilled on minerals under BLM jurisdiction.

RFD Conclusion

CBNG

During the life of the plan, it is estimated that the number of CBNG wells that may be drilled throughout the Powder River and Billings RMP Planning Areas would range from a low of 6,470 to a high of 18,225—of which 2,975 to 8,450 would be drilled on BLM-administered minerals. There would be from 5,800 to 16,400 producing CBNG wells, of which 2,500 to 7,500 would be BLM administered. For a graphical presentation of these predictions, refer to Map 4-1 in Chapter 4 of this EIS. Table MIN-1 at the end of this section presents the RFD Expanded Development Scenario in numerical form.

These wells would require 250 to 700 field compressors, and 25 to 70 sales compressors. From 3,900 to 11,200 miles of plastic, low-pressure gathering lines would be needed. These lines would be laid in the travel routes to the wells and would follow the roads to the field compressors. Five hundred to 1,400 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors, and approximately 480 miles of sales lines would be laid to the main transmission lines. This would result in 22,500 to 74,000 acres of disturbance.

Powder River RMP Area

During the next 20 years, it is estimated that the number of CBNG wells that may be drilled throughout the Powder River RMP area, would range from a low of 5,400 to a high of 15,600. The number of wells drilled each year would range from 200 to 1,100. There also would be 4,800 to 13,400 producing CBNG wells, which would require 200 to 550 field compressors and 20 to 55 sales compressors. From 3,200 to 8,900 miles of plastic, low-pressure gathering lines would be needed. These lines would be laid in the travel routes to the wells and would follow the roads to the field compressors. From 400 to 1,100 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors. Approximately 290 miles of sales lines would be laid to the main transmission lines. This would result in 24,400 to 73,600 acres of disturbance.

Billings RMP Area

During the next 20 years, it is estimated that the number of CBNG wells that may be drilled throughout the Billings RMP area, would range from 1,100 to 2,600. There would be 100 to 2,350 producing CBNG

wells, which would require 5 to 100 field compressors and 1 to 10 sales compressors. One hundred to 1,600 miles of plastic, low-pressure gathering lines needed. These lines would be laid in the travel routes to the wells and would follow the roads to the field compressors. From 10 to 200 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors. Approximately 170 miles of sales lines would be laid to the main transmission lines. This would result in 350 to 18,400 acres of disturbance.

Conventional Oil and Gas

Based on the assumptions listed at the beginning of this section, the number of conventional oil and gas wells that could be drilled would range from 450 to 1,775. The number of wells drilled each year would range from two to seven in each of the 13 counties if the wells were distributed equally among the counties. No estimates of disturbance were made for conventional wells.

Powder River RMP Area

The RFD estimates that 200 to 800 conventional wells would be drilled in the next 20 years in the Powder River RMP area. Seventy to 300 of these wells would be drilled on minerals under BLM jurisdiction. Most of these wells would be drilled in or near the existing fields.

Billings RMP Area

The RFD estimates that 250 to 975 conventional wells would be drilled in the next 20 years in the Billings RMP area. Twenty-five to 100 of these wells would be drilled on minerals under BLM jurisdiction. Most of these wells would be drilled in or near the existing fields.

Reasonably Foreseeable Future Actions—Alternatives B, C, D, E, F, G, and H

The RFFA predictions for Alternative B, C, D, E, F, G and H were developed using the same general assumptions as the RFD. However, the coal tonnages for the Indian reservations are based on the thickest coals (coals over 20 feet thick).

Development Potential

The development potential for CBNG and conventional wells for all owners on the Crow Reservation, Northern Cheyenne Reservation and the Custer National Forest is described in the text that follows.

Ashland District, U.S. Forest Service

CBNG

Coal resources are primarily concentrated in the southern portion of the district. Otter Creek and the Tongue River drainages have eroded or exposed many of the coal zones. Based on the coal resources, the RFFA predicts that approximately 200 wells may be drilled over 20 years. This would result in approximately 400 acres of long-term disturbance.

Crow Reservation

CBNG

Based on the identified coal resources within the reservation, 1,400 to 4,000 CBNG wells could be drilled; of these, 1,300 to 3,600 would be producing wells. The wells would probably be located in the eastern portion of the Crow Reservation. This would require from 50 to 150 field compressors and from five to 15 sales compressors. Eight hundred to 2,400 miles of plastic, low-pressure gathering lines would be needed. These lines would be laid in the travel routes to the wells and would follow the roads to the field compressors. One hundred to 300 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors. No more than 60 miles of sales lines would be laid to the main transmission lines. This would result in 7,000 to 12,000 acres of disturbance.

Conventional

Based on historical drilling rates, 10 to 50 conventional wells could be drilled in the next 20 years.

Northern Cheyenne Reservation

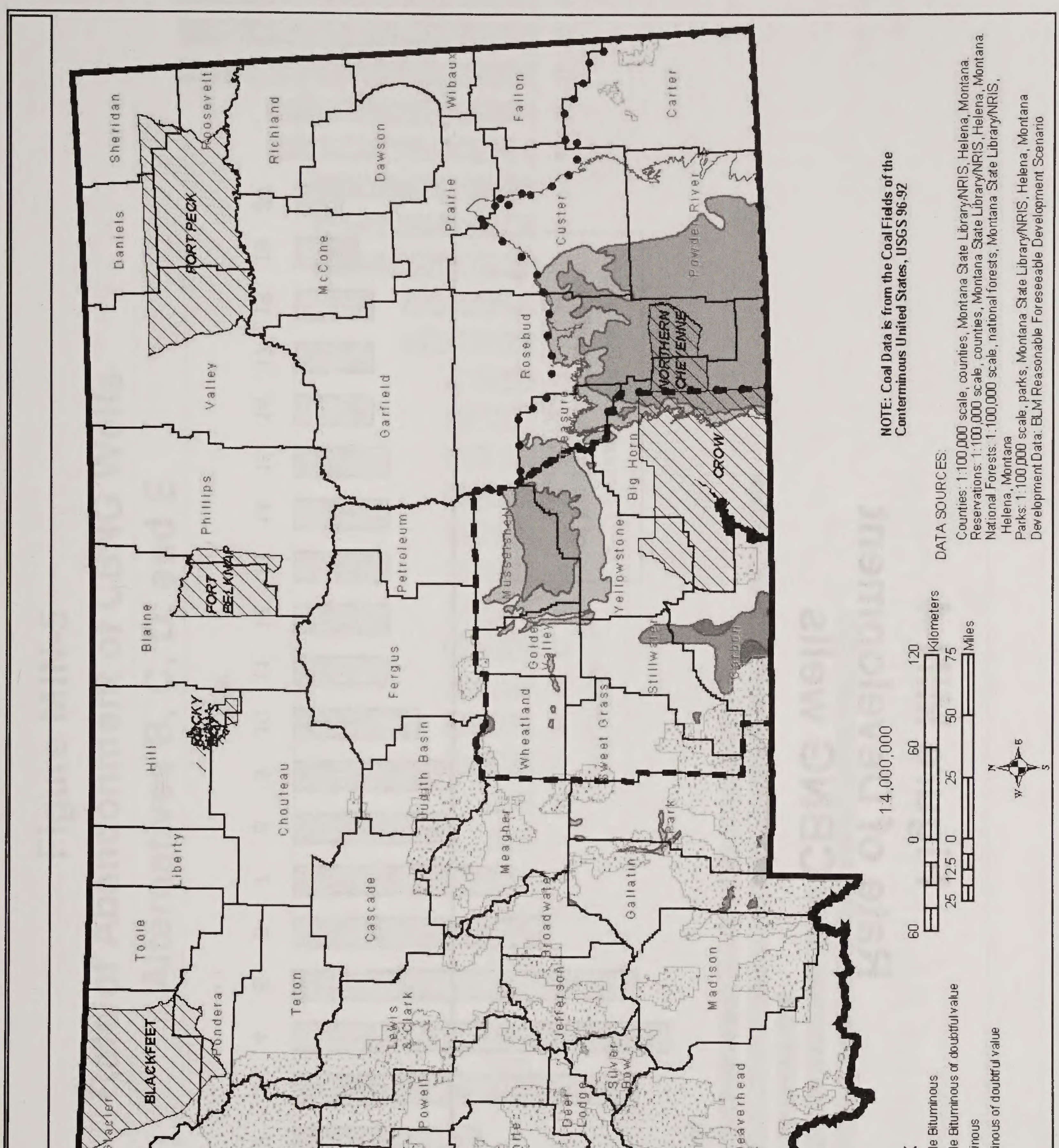
CBNG

Based on coal resources, 1,400 to 4,000 CBNG wells could be drilled on the reservation; of these, there would be 1,300 to 3,600 producing wells. The wells would most likely be located along the southern boarder of the reservation and extend from the western to the eastern boundaries. This would require 50 to 150 field compressors, and from five to 15 sales

compressors. Eight hundred to 2,400 miles of plastic, low-pressure gathering lines would be needed. These lines would be laid in the travel routes to the wells and would follow the roads to the field compressors. From 100 to 300 miles of low-pressure steel lines would be laid from the field compressors to the sales compressors. There would be no more than 60 miles of sales lines laid to the main transmission lines. This would result in 7,000 to 12,000 acres of disturbance.

Conventional

Based on historical drilling rates, one to five conventional wells could be drilled on the reservation in the next 20 years.



MIN-1: Coal Rank RFD Map

**Figure MIN-4
Rate of Development
CBNG wells**

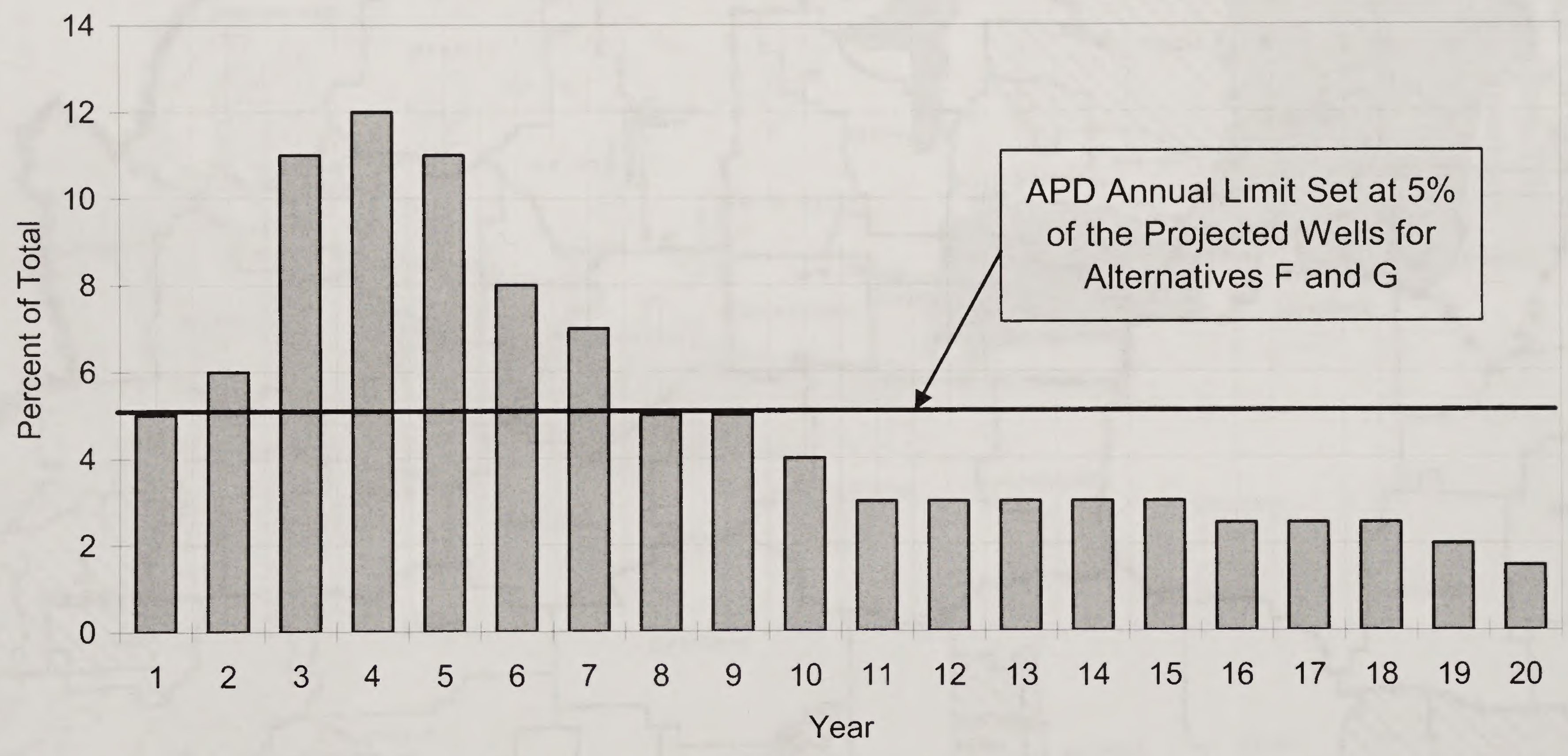
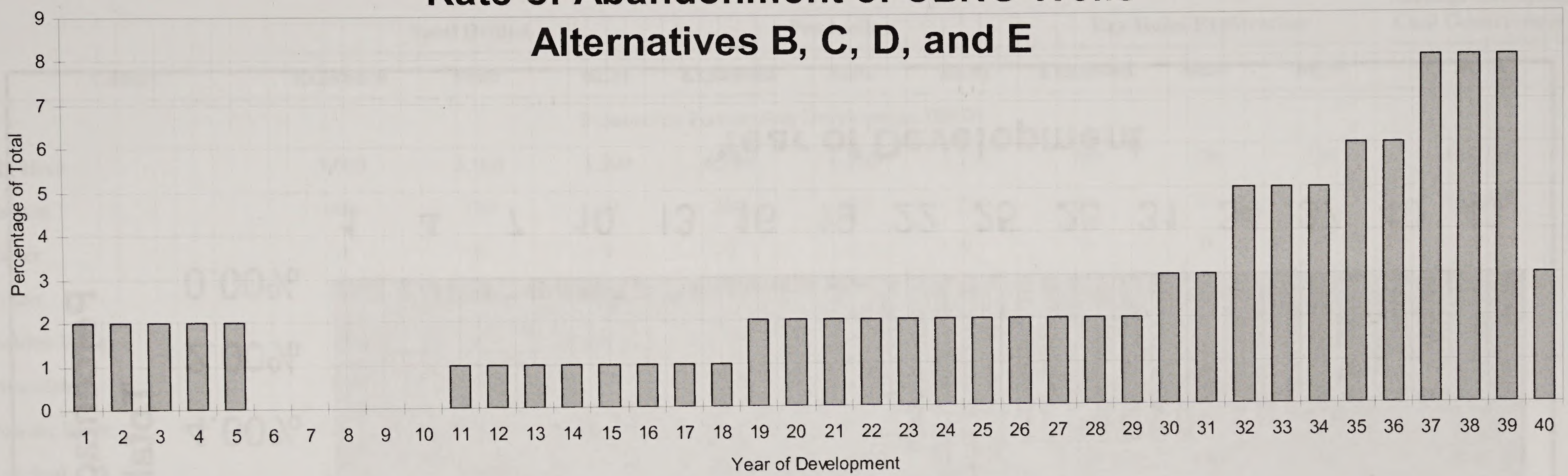


Figure MIN-5
Rate of Abandonment of CBNG Wells
Alternatives B, C, D, and E



1) Wells will be drilled over a 20 year period.
2) Wells may have a productive life of 20 years.
3) A well drilled in the 20th year with a productive life of 20 years would be plugged in the 40th year.
4) Initially (years 1-5) some wells will be P&A (1%-2%) while defining the productive areas this accounts for increased dry holes.
5) During years 6-10 most of the wells drilled will be productive.
6) After 10 years some wells will start to be P&A due to declining production.
7) The majority of the abandonment will occur in the last few years, as field production declines to uneconomic.
8) After 40 years all wells will be P&A.

Figure MIN-6
Rate of Abandonment of CBNG Wells
Alternatives F & G

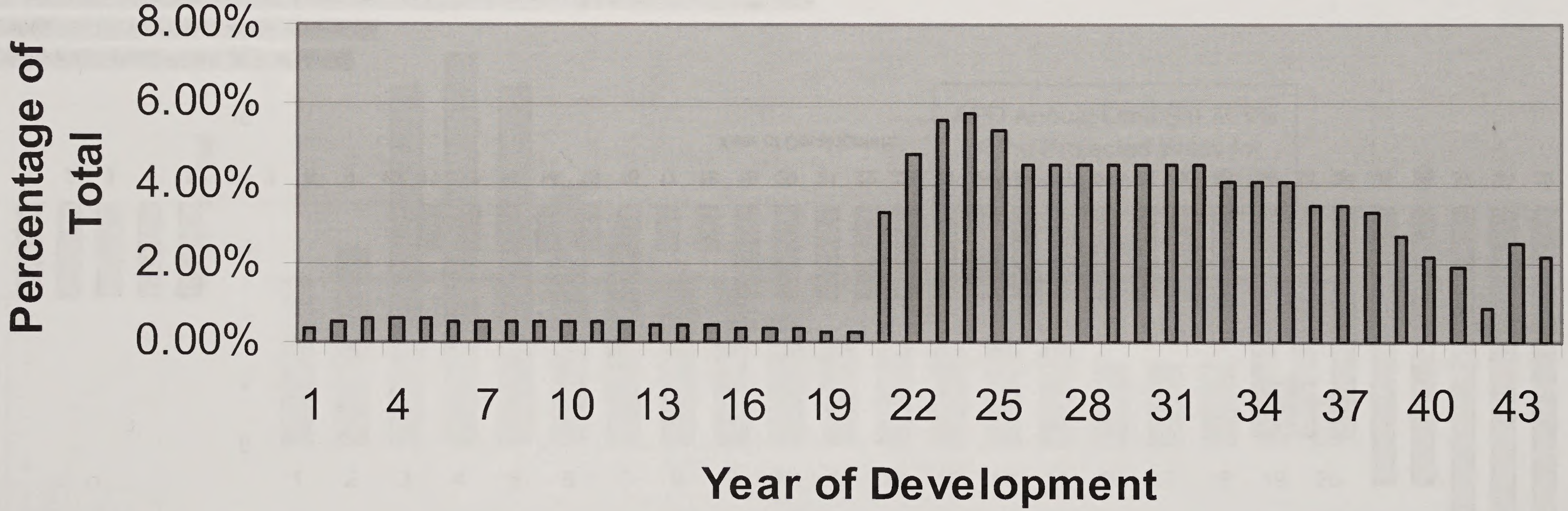


TABLE MIN-1
RFD/RFFA NUMERICAL PREDICTIONS FOR EXPANDED CBNG DEVELOPMENT SCENARIO

County	Total Drilled			Production			Dry Holes/Exploration			Acreage Overlying Coal Occurrences
	Expanded	State	BLM	Expanded	State	BLM	Expanded	State	BLM	Acres
Reasonably Foreseeable Development (RFD)										
Big Horn	7,000	3,500	3,500	6,300	3,150	3,150	700	350	350	524,738
Carbon	400	320	80	360	288	72	40	32	8	448,000
Carter	0	0	0	0	0	0	0	0	0	0
Custer	300	230	70	270	207	63	30	23	7	418,000
Golden Valley	0	0	0	0	0	0	0	0	0	0
Musselshell	150	130	20	135	117	18	15	13	2	764,000
Powder River	6,700	3,350	3,350	6,030	3,015	3,015	670	335	335	713,500
Rosebud	2,800	1,400	1,400	2,520	1,260	1,260	280	140	140	1,005,500
Stillwater	700	665	35	630	599	32	70	67	4	65,500
Sweetgrass	0	0	0	0	0	0	0	0	0	0
Treasure	25	24	1	23	22	1	3	2	0	153,500
Wheatland	0	0	0	0	0	0	0	0	0	0
Yellowstone	150	140	10	135	126	9	15	14	1	678,000
Total RFD	**18,225**	**9,759**	**8,466**	**16,401**	**8,782**	**7,619**	**1,821**	**975**	**847**	**4,770,738**

TABLE MIN-1
RFD/RFFA NUMERICAL PREDICTIONS FOR EXPANDED CBNG DEVELOPMENT SCENARIO

County	Total Drilled			Production			Dry Holes/Exploration			Acreage Overlying Coal Occurrences
	Expanded	State	BLM	Expanded	State	BLM	Expanded	State	BLM	Acres
				Reasonably Foreseeable Future Actions (RFFA)						
Northern Cheyenne	4,000	0	0	3,600	0	0	400	0	0	445,000
Crow	4,000	0	0	3,600	0	0	400	0	0	332,000
Forest Service	200	0	0	180	0	0	20	0	0	501,500
Total RFFA	**8,200**	**0**	**0**	**7,380**	**0**	**0**	**820**	**0**	**0**	**1,278,500**
Total RFD and RFFA	**26,425**	**9,759**	**8,466**	**23,781**	**8,782**	**7,619**	**2,641**	**975**	**847**	**6,049,238**
Powder River RMP	15,635	7,899	7,716	14,071	7,109	6,944	1,563	790	772	2,726,033
Billings RMP	2,590	1,860	750	2,330	1,673	675	258	185	75	2,044,705
RFD Totals	**18,225**	**9,759**	**8,466**	**16,401**	**8,782**	**7,619**	**1,821**	**975**	**847**	**4,770,738**
	Big Horn County		**Drilled**	**Production**	**Dry Holes**					
Powder River RMP	83.00%		5810	5229	581					
Billings RMP	17.00%		1190	1071	119					

Note: Percentages indicate portion of Big Horn county overlying known coal occurrence within each RMP excluding the Crow Reservation lands.

Note: The adjustment of numbers in Table MIN-1 is due to the SEIS Planning Area consisting of the Billings and Powder River RMP Areas which do not include Park, Gallatin, and Blaine Counties which were included in the 2003 Statewide FEIS.

CUMULATIVE PROJECTS EVALUATED

Compliance with the National Environmental Protection Act (NEPA) requires analysis of cumulative effects for each alternative. Cumulative effects on the environment are those that result from the incremental impacts of an alternative when added to the other past, present and reasonably anticipated future actions, regardless of who undertakes those actions. In analyzing cumulative effects from this project, it will be important to understand the incremental impacts from other past, present, and future actions planned for the RMP areas. However, not every project can be included in the analysis or the result could become cumbersome; thus, providing decision makers with extraneous information. Therefore, the importance of scoping cannot be overstressed because it provides the initial opportunity to identify boundaries for a meaningful analysis. The cumulative effects study approach is defined by discussing the Study Area Delineation (spatial boundary); past, present, and future projects that meet a minimum criteria of magnitude as to add to the cumulative effect and time frame for the analysis and is discussed in the conclusions section of each alternative.

Study Area Delineation

The planning area for BLM is the Billings RMP area (10,791,964 acres) and the Powder River RMP area (8,567,125 acres). Acre estimates are for all land within the RMP's regardless of ownership, federal, state or private.

The planning area proposed for the supplemental environmental impact statement (SEIS) RMP is exceptionally large and limits the type of analyses that can be included in the subject analysis. It is important to note that the objective of the cumulative analysis is not to perform the perfect analysis, but to select projects that would be appropriate to the subject analysis and aid in the selection of a preferred alternative. With this in mind, the objective is not to make an attempt to choose all projects throughout the entire state of Montana that might add to the cumulative effect of the BLM's action. This extreme is simply not practical; however, if the thought is more focused, cumulative impact analysis could be chosen on a practical level. Cumulative impacts that might affect other resources are not considered as regionally extensive, the projects/activities to consider may be different. For example, groundwater impacts would be limited to the general area of CBNG production. This would also be the case with soils, agriculture and grazing, cultural and paleontological resources, geology and minerals, Indian trust assets, socioeconomics, and others. Other than air quality related impacts (including visual) and surface and ground water influences from Wyoming CBNG development, BLM believes the proposed study area is appropriate for this plan and is consistent with other BLM plans. Using this approach, combined with the general knowledge of the area, consideration of a study area that is essentially the Powder River Basin is appropriate. We are, however, limited to some extent in what can be considered and must strive to choose those areas and projects and activities that are truly applicable to the process.

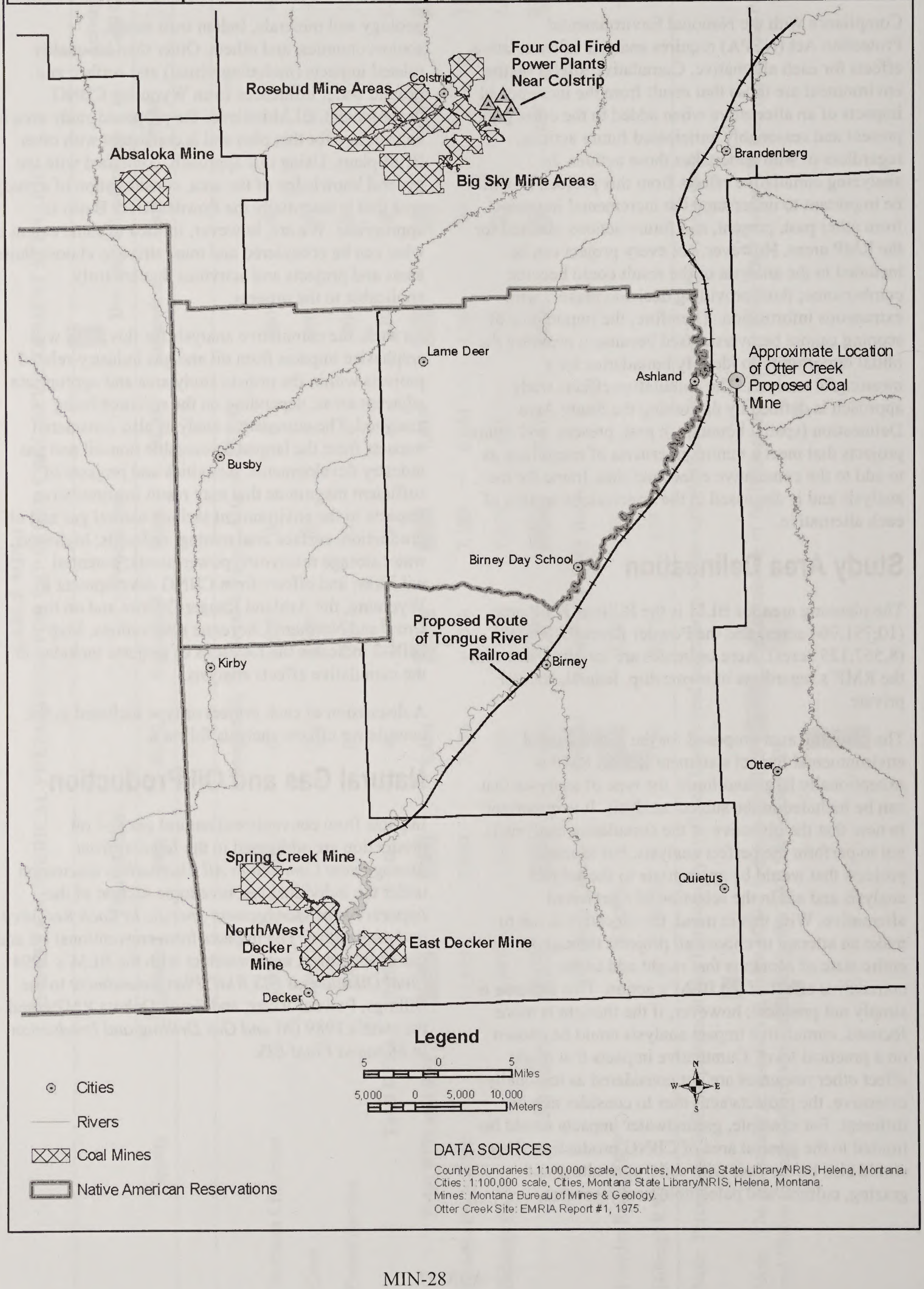
As such, the cumulative analysis for this SEIS will emphasize impacts from oil and gas industry-related projects within the project study area and appropriate adjacent areas, depending on the resource being analyzed. The cumulative analysis also considered impacts from the largest foreseeable non-oil and gas industry developments. Activities and projects of sufficient magnitude that may result in cumulative impacts to the environment include natural gas and oil production; surface coal mining; railroads; highways; water storage reservoirs; power plants; potential wildfires; and effects from CBNG development in Wyoming, the Ashland Ranger District and on the Crow and Northern Cheyenne reservations. Map MIN-2 indicates the locations of projects included in the cumulative effects analysis.

A discussion of each project or type included in the cumulative effects analysis follows.

Natural Gas and Oil Production

Impacts from conventional natural gas and oil production are addressed in the *Impacts from Management Common to All Alternatives* discussion under the individual resource topic section of the *Impacts From Management Specific to Each Resource and Alternative*. The impacts from conventional oil and gas development are consistent with the BLM's 1994 *Final Oil and Gas EIS RMP Plan Amendment* to the Billings, Powder River, and South Dakota RMPs, and the state's 1989 *Oil and Gas Drilling and Production in Montana Final EIS.*

MIN-2: Location Map of Cumulative Effects Projects With CBM Emphasis Area



Surface Coal Mining

Several mines are present in and around the CBNG planning area. They include operating mines, mines undergoing expansion, reclamation of older mines, and future planned mines. Mines that are generally located within the Powder River Basin and have a potential to add to the cumulative impact include the Spring Creek, Decker, Big Sky, Rosebud, and Absaloka. These mines are located in three general areas: the Spring Creek and Decker mines are in southeast portion of Big Horn County just east of the Crow Reservation; the Absaloka mine is located just outside the northeastern corner of the Crow Reservation in Big Horn County; and the Rosebud and Big Sky mines are located near Colstrip, Montana, just north of the Northern Cheyenne Reservation. Table MIN-2 shows the annual production (2004) of each mine in the planning area along with environmental data for permitted acres, disturbed acres, and backfilled and re-topsoiled acres.

In addition to the quantities identified in the Table MIN-2, the BLM has been conducting a coal screening to identify additional lands that may be suitable for leasing over the next 20 years. Currently, the study has identified lands immediately adjacent to the existing mines. These newly-identified potential lease areas amount to approximately 16,000 acres. Approximately 41,810 acres remain to be disturbed by mining operations during the next 20 years. This estimate is based on current activities and foreseen future developments.

Based on the analysis conducted for this study, it is estimated that the current (2003) production of 36.1 mmtpy of coal in the Montana PRB study area would increase to 56.0 mmtpy under the lower production scenario and to 83.0 mmtpy under the upper production scenario by 2020. Production at currently operating mines is projected to continue throughout the study period. In addition, three potential new developments (i.e., P&M Ash Creek Mine, Otter Creek Mine, and Kinsey Mine) have been identified in the Montana PRB study area. Under the lower production scenario, it is projected that production at the P&M Ash Creek Mine would be initiated by 2010; the Otter Creek and Kinsey mines would not be developed. Under the upper production scenario, it is projected that production would be initiated by 2010 at both the Otter Creek and P&M Ash Creek mines and by 2015 at the Kinsey Mine. Development of these mines would be dependent on markets for the coal and may be tied to development of infrastructure including the Tongue River Railroad and/or power plants. It is assumed that development of the Otter Creek Mine would require construction of Tongue River Rail Company's (TRRC's) proposed Tongue River Railroad and a power plant near Miles City, Montana. However, at this time, no application has been filed for a new power plant at this location. It is assumed that the Kinsey Mine would be developed in response to construction of a mine-mouth power plant; however, an application for a new power plant at this location has not been filed at this time.

Surface water quality within the vicinity of the coal mines is impacted by increased sediment load resulting from increased erosion during mining. This is mitigated by the use of sediment settling ponds and the vegetating of overburden and topsoil storage areas. The discharge of groundwater pumped from mine pits may also affect surface water depending on the quality of groundwater within the mine vicinity and the quantity of groundwater discharged. Much of the groundwater pumped from the mine pits is stored and used to control dust on roads, truck and train car loading areas, and the mine face. In some instances, mining activities require the diversion of streams or drainage areas that are within the area to be mined. Approximate original topography, including stream channels and drainage areas, are restored during mine reclamation activities. All mines are required to monitor their discharges and obtain Montana Pollution Discharge Elimination System permits. The majority of discharges are related to storm responses with the exception of the Decker mines, which has a permit for a regular discharge of 4.5 cubic feet per second into the Tongue River.
Impacts to groundwater resources resulting from surface coal mine activities are usually related to drawdown and quality issues from backfilled spoils. Coal beds are among the most dependable and utilized aquifers in

TABLE MIN-2
SURFACE MINES WITHIN THE CBNG PLANNING AREA

Mine	Annual Production 2004 (Short Tons)[1]	Permitted Surface Acres	Disturbed Acres	Backfilled and Re-topsoiled Acres
Spring Creek	12,068,328	6,700	3,000	550
Decker (North/West and East)	8,241,467	11,400	6,921	1,966
Big Sky (Area A&B)	2,850,000	8,100	3,600	2,600
Rosebud (Areas A, B, C, D, and E)	12,664,823	26,400	15,255	6,969
Absaloka	6,474,339	5,400	3,714	2,563
Total	42,298,957	58,300	32,490	14,648

Note: This table shows the cumulative disturbances and reclamation efforts associated with each of the surface mining operations within the CBNG planning area.
[1]Energy Information Administration, Annual Coal Report, 2004, DOE/EIA-0584(2004) (Washington, DC, September 2005). http://www.eia.doe.gov/cneaf/coal/page/acr/table9.html

eastern Montana, because of their fracture-related transmissivity and lateral continuity. Adjacent portions of these aquifers discharge water into the mining pit, which requires that it be pumped-off resulting in the lowering of the water levels within aquifers adjacent to the mine. The area affected and the distance from the mine affected depends on the particular aquifer characteristics of the area, presence of faults, rates of surface water and precipitation recharge, and other factors, and will vary depending on the location of the mine. Groundwater wells, springs, and surface streams within the area can be impacted by the lowered water levels. Those located nearest the mine experience the greatest impact. In the mining areas near Colstrip and Decker, coal aquifers have shown drawdown as much as 75 feet and a radius of impact up to 4 miles (Wheaton and Metesh 2001). The resulting total area of groundwater impact from coal mines is calculated to be 366,000 acres. The rate at which water levels recover varies between mining regions, but normally requires more than 20 years (Wheaton and Van Voast 1998).

Overburden replaced in the mine pits during reclamation is approximately inverted from its original orientation. The mineral content of these near-surface unsaturated and weathered rock layers used in typical overburden affect the groundwater quality within the area of the reclaimed mines. The resulting poor water quality is present for many years after mining is completed. Elevated levels of sodium, magnesium, calcium, bicarbonate, chlorides, and sulfates are possible, as well as increased total dissolved solids (TDS). Dissolution of these salts causes increases in TDS concentrations in the spoils aquifers that have been observed at levels 50 percent to 200 percent greater than the adjacent bedrock aquifers (Wheaton and Van Voast 1998). With time, some sites return to pre-mining quality; however, the impacts to water quality may be everlasting at other sites where soluble salts are continuously generated by weathering and oxidation.

Coal Mine Impacts on Air Quality

Coal mines have an effect on air quality within the region surrounding the surface operations. Air pollutant emissions data are available for five surface coal mines within the planning area; three are in Big Horn County (Absaloka, Spring Creek, and Decker mines), and two are in Rosebud County (Big Sky and Rosebud mines). Table MIN-3 shows the average air pollutant emissions from the mines within the planning area. Volatile organic compounds (VOCs) shown in the table would also include any fugitive methane vented from the mines. Future impacts also would be realized from opening new mines, expanding existing mines, and installing power generation plants at existing coal mines. Wyoming mines would also have an effect on Montana's air quality. Emission sources for these mines as considered in the air quality model have been included in the Air Model Appendix.

TABLE MIN-3
AVERAGE AIR POLLUTANT EMISSIONS FROM SURFACE MINES WITHIN THE PLANNING AREA (TONS/YEAR)

Source	PM_{10}[1]	CO[2]	NO_2[3]	SO_2[4]	VOCs[5]
Existing Coal Mines (5)—Avg/Mine	412.1	323.4	290.2	56.5	18.8

Notes: This table summarizes the impacts to air quality from surface mining sources within the planning area (MDEQ—1999 Air Quality Monitoring Data). Values were obtained from 1999 Toxic Release Inventory for the State of Montana.

[1]PM_{10}—Particulate matter that is less than or equal to 10 microns in size.

[2]CO—Carbon monoxide

[3]NO_2—Nitrous oxides

[4]SO_2—Sulfur dioxide

[5]VOCs—Volatile organic compounds

Highways

There are no current proposals for new highways within the CBNG planning area. It is assumed that several secondary highways, state routes, and county roads will undergo some form of repair, resurfacing, widening, or extension during the course of CBNG development. Currently, a list of proposed road improvements within the CBNG planning area is not available for analysis and quantification. These activities, however, would subject the adjacent lands to impacts associated with linear construction and surface disturbances. For the purposes of this analysis, we are assuming that 250 miles of existing road would be improved over the next 20 years.

Water Storage Reservoirs

The Tongue River flows about 100 miles from its headwaters in Wyoming's Bighorn Mountains to the Tongue River Reservoir. The reservoir is approximately 8 miles long and 1 mile wide, with an average depth of 20 feet, and was completed in 1940. Water leaving the north end of the reservoir flows about 190 miles, northeasterly, until it reaches its confluence with the Yellowstone River at Miles City.

The reservoir was enlarged in 1999, at the request of the Department of Natural Resources and Conservation (DNRC), Northern Cheyenne Tribe, and the U.S. Bureau of Reclamation. The enlargement included the reconstruction of the dam and disturbance of 157 acres. The disturbance included aggregate mining, roads, staging areas, and railroad layout areas, some of which have been reclaimed. As a result of the enlargement, the reservoir capacity was increased by 13,000 acre-feet, the surface water level raised by 4 feet, and the surface area expanded by some 400 acres to nearly 3,615 acres.

Power Generation Plants

Five existing power generation plants are located within the CBNG planning area, and all are coal-fired. Four are located in Rosebud County near the coal mine area and one is located in Billings. The resource area most affected by the burning of coal to produce electrical power is air quality. Air quality data from all five power generation plants are available. Table MIN-4 summarizes the impacts to air quality from these plants within the planning area, according to the MDEQ 1999 Air Quality Monitoring Data.

Hardin Generating Station

The Hardin Generating Station has been permitted, constructed, and is operating as a direct combustion facility. The 116-megawatt coal-fired plant was retrofitted into an existing manufacturing facility, resulting in reduced surface disturbances and no new power lines were needed to move the power. The air quality permit was issued to Rocky Mountain Power for the Hardin Generating Station, however, the project ownership has changed hands, and is now backed by MDU Resources Group, an affiliate of the Montana-Dakota Utilities. The permit was issued by the Montana Department of Environmental Quality in December 2004.

Coal to fuel the plants comes from the nearby Absaloka coal mine operated by Westmoreland. The power plant will burn an estimated 650,000 tons annually. The electricity was contracted by a subsidiary of BC Hydro of Vancouver, British Columbia, the third-largest electrical utility in Canada.

A good source of water comes from the Bighorn River which flows nearby but there is zero discharge of water back into the river as the plant was designed with a

closed internal system. The Hardin project is the first plant in the state to install technology to control mercury emissions and will be "state of the art" in pollution control. The technology the plant employs will be a test site for mercury controls during its first three years of operation. Before the three-year period expires, the company must install a technology known as activated carbon injection or a similar technology approved by the Montana Department of Environmental Quality.

Additional information regarding the Hardin Generating Station, such as estimated emission levels, is available in the Air Quality appendix.

Roundup Power Plant

Another power plant project considered in the air quality analysis is the Roundup project proposed by the Bull Mountain Development Company, No. 1, LLC (Bull Mountain). They propose to build a coal-fired electricity generation plant, called the Roundup Power Project, and related facilities on a 208-acre site about 13 miles south-southeast of Roundup, Montana, in Musselshell County. The plant would consist of two steam turbine generating units each burning pulverized coal. The nominal generation capacity would be 780 megawatts.

The boilers would be fueled with coal from the nearby Bull Mountain Mine. Coal would be transported from the mine to the power plant via a 4,000- foot-long conveyor. Power generated by the plant would be transmitted via a 28.2- mile 161kV transmission system, consisting of three circuits, to the Broadview Substation. Boiler water would be supplied by wells drilled into the Madison Formation.

In January, 2003, the DEQ issued a Clean Air Act permit to Bull Mountain Development Corp. for this new plant. However, on July 13, 2005, the DEQ informed Bull Mountain Development Corp. that their air quality permit had expired and a new one must be obtained before construction of the power plants can proceed. The DEQ has offered to extend the permit, if the corporation agrees to additional stipulations for toxic air emissions.

A coal-fired power plant proposed for east of Great Falls by Southern Montana Electric Generation and Transmission Cooperative received a draft air-quality permit from the DEQ. The city of Great Falls joined five rural electric cooperatives in proposing the Highwood Generating Station. The technology planned at the Highwood plant is called circulating fluidized bed combustion. The new technology produces less mercury, sulfur dioxide and other toxic emissions. The plant would generate 250 megawatts and is scheduled to be built by 2008 on a site 8 miles east on the south side of the Missouri River. The plant will burn approximately 1,100,000 tons of coal yearly.

Other power plants maybe envisioned due to the electrical industry's deregulation and the increased demand nation wide. Some of these plants may find it advantageous to locate in Montana near a source of coal or natural gas; however, no new plants were presented to the DEQ for permitting at the time of the 2003 Statewide FEIS.

Wildfires

The BLM Fire Management Program suppresses wildfires and uses prescribed fires to achieve land management objectives. Nationally, 63 percent of wildfires are caused by lighting and the remaining 37 percent by human activities. The average wildfire consumes approximately 370 acres, but the acreage can more than double in severe years that have drought, high winds, or above normal lightning.

Prescribed fires are carefully planned to remove old, woody vegetation, prepare areas for reseeding, or reduce the natural accumulation of dead vegetation. They make room for growth of more nourishing forage for livestock and wildlife, and are often designed to burn a mosaic pattern, leaving patches to serve as cover for some wildlife species. The average prescribed fire covers 150 acres of land. Based on previous RMPs, it is estimated that 25 wildfires would occur per year in the planning area. The fires would range in size from 1/4 acre to 1,000 acres. Surface disturbances caused from fire lines would average 3 acres per fire or a total of 75 acres per year.

TABLE MIN-4
AVERAGE AIR POLLUTANT EMISSIONS FROM FIVE MAJOR SOURCES WITHIN THE PLANNING AREA
(TONS/YEAR)

Source	PM_{10}[1]	CO[2]	NO_2[3]	SO_2[4]	VOCs[5]
Existing Power Plants (5)—Avg/Plant	1534.1	578.9	7977.1	5339.4	69.8

Note: Values were obtained from the EPA Critical Air Pollutants 2001 for the State of Montana.
http://www.epa.gov/air/data/emcatbar.html?st~MT~Montana

1PM10—Particulate matter that is less than or equal to 10 microns in size

2CO—Carbon monoxide

3NO2—Nitrous oxides

4SO2—Sulfur dioxide

5VOCs—Volatile organic compounds

Wyoming CBNG Production

CBNG production in Wyoming is concentrated in the Powder River Basin. CBNG resources of the Powder River Basin are more extensively developed in Wyoming than in Montana. Most of the surface area of the basin is located in Wyoming, with 92 percent of the coal volume located in the Powder River basin lying within Wyoming (Ellis et al., 1999a). The CBNG development in Wyoming has the potential to impact water resources in Montana through the drawdown of groundwater within coal seam aquifers that extend from Wyoming north into Montana and by the discharge of CBNG-produced waters in Wyoming to surface waters that flow north into Montana. The potential magnitude of the impact to Montana water resources from Wyoming CBNG production is tied to the RFD of CBNG in Wyoming. Projections for the RFD of CBNG in the Wyoming portion of the Powder River basin adjacent to Montana have been the subject of recent BLM reports.

CBNG development in Wyoming has the potential to cause substantial impacts in Montana to surface water quality and groundwater resources. The Wyoming DEQ and the Montana DEQ have adopted an interim memorandum of cooperation on limiting discharge to watersheds that extend into Montana, the probability of future agreements is tentative.

The *Coalbed Methane Project Final EIS (Wyodak EIS)* (BLM 1999b) projected 6,000 CBNG wells in the Buffalo Field Office Area. The water model, done as part of the EIS, estimated an average production rate of 12 gpm per CBNG well. This level of development was estimated to result in an increase of approximately 1.1 percent (452 cfs to 457 cfs) in the average flow volume of the Powder River at Moorhead, Montana (BLM 1999b), and an increase of approximately 50 percent (22 cfs to 33 cfs) in the average flow volume in the Little Powder River at the Weston station, which is located approximately 20 miles south of the Wyoming/Montana border. These increases are based on yearly averages. However, during low-flow periods, the Powder River flow volume could be increased by more than 800 percent as a result of the discharge of CBNG-produced waters. Flow volumes in the Little Powder River would consist entirely of discharged CBNG-produced waters (BLM 2001b).

The quality of CBNG produced water from individual wells in the Wyoming portion of the PRB shows considerable variability (Rice et al, 2000); water quality parameters such as SAR vary from approximately 5 to over 30 and TDS varies from approximately 250 million gallons per liter (mg/L) to more than 2000 mg/L. Watershed averages in Wyoming also show variation (BLM, 1999b.); water quality parameters such as SAR vary from an average of 17 in the Powder River Watershed to 9 in the Little Powder River watershed. As CBNG development continues in Wyoming, these average water quality parameter values may change. Surface water quality would be affected by CBNG water discharge, with yearly average SAR values increasing from 4.0 to 4.1 in the Powder River and from 6.0 to 7.5 in the Little Powder River. Impact to the quality of water within the Powder River during low-flow periods is expected to increase water quality concentrations for compounds common to CBNG produced water, including increases in the SAR from values that could be as low as 1 up to approximately 17. During low-flow periods in the Little Powder River, SAR is expected to increase from approximately 6.5 to an estimated value of

approximately 9. The Wyoming EIS (BLM, 1999b.) did not address potential impacts to the Tongue River from discharge of CBNG-produced waters within Wyoming. However, it is expected that impacts of similar magnitude to those predicted for the Powder and Little Powder could occur.

Following the release of the Wyodak EIS (BLM 1999b), the BLM has reassessed the RFD for the Wyoming portion of the Powder River Basin and has issued a new RFD (BLM 2001a). This more recent reasonably foreseeable development study by the BLM indicates that the total number of CBNG wells in the Wyoming portion of the Powder River Basin may approach 50,000 wells (BLM 2001a). This level of development represents an increase of more than 8 times the number of CBNG wells included in the 1999 Wyodak EIS, and if realized, could have a corresponding increase in impact on the quantity and quality of surface water in Montana's Powder River Basin watersheds in terms of annual average measures and especially during periods of low-flow or base-flow. However, actual impacts will be dependant upon the manner in which discharges are managed with respect to CBNG development in Wyoming.

Rivers within the Wyoming portion of the PRB show considerable seasonal variation in terms of flow volume and water quality. The flow volume in the Powder River ranges from a maximum of 1,400 cubic feet per second (cfs) to a minimum of 0.5 cfs. Water quality also varies because flow volume contains varying amounts of meteoric water added to the base-flow contributed by groundwater. If CBNG water discharge rates are essentially constant throughout the year, resultant flows in the river would vary depending upon the ratio of CBNG discharge to natural river flow. Impacts to the Powder River would include a 9 percent increase in the annual average flow volume (450 cfs to 500 cfs), as well as an increase in the annual average SAR value to 5.2. Impacts during natural low-flow periods, however, would cause the river to flow at rates 70 times normal with SAR values in excess of 17.

Annual average flow within the Little Powder River with the impact of CBNG discharge water is extrapolated to increase from 22 cfs to 92 cfs and a resultant SAR of 9. Depending on how CBNG-discharges are managed in Wyoming, these flow rates and water qualities could be maintained during traditionally low-flow periods when the river is normally often dry.

Impacts to the Tongue River drainage are not included in the Wyodak EIS, however, impacts to surface water quantity and quality resulting from the increase in the number of CBNG wells and the resultant increase in the volume of CBNG water discharged in Wyoming are possible. The Upper Tongue River watershed is currently the site of CBNG production and it is expected that more development would occur. Impacts to the Tongue River in Montana are expected to be commensurate with impacts to the Powder and Little Powder Rivers by Wyoming CBNG production. These impacts would result in increases in surface water quantity and decreases in quality. This could result in 3 to 5 times more water entering Montana and an increase in SAR from 0.7 to 5. This is important because Tongue River water quality is the highest in the PRB and the river feeds the Tongue River Reservoir.

Groundwater resources in Montana could also be impacted from CBNG production in Wyoming. CBNG-producing wells in northern Wyoming would cause a drawdown of coal aquifers on adjacent land, with groundwater drawdown possibly extending northward into Montana. Groundwater computer modeling for the Wyodak EIS indicates that the 5-foot drawdown level could extend up to 18 miles from the edge of production, given a 12-gpm per well rate of water withdrawal (BLM 1999b). The modeling values are based on assumptions made regarding the known geology of the Wyoming portion of the basin, which field data has shown to differ from the Montana portion of the basin. The Wyoming coal seams that have been developed are deeper and thicker than the seams in Montana. In addition, the 12-gpm water production value for the state was a "snap-shot" derived from current production data at a single point (1997) early in the life of the PRB CBNG play. The 20-year average rate of 2.5 gpm for Montana was derived from carefully organized data from a single CBNG field considering production trends with time. Nonetheless, both the 12 gpm and the 2.5 gpm rates are projections that may need to be monitored and refined over time as CBNG development proceeds. Given these groundwater modeling results and related assumptions, if CBNG fields were located in Wyoming adjacent to the border with Montana, this could affect groundwater levels for a distance of up to 18 miles into Montana, assuming the parameters used in the Wyoming computer model are applicable to this area of Montana. Drawdown impacts of this magnitude would result in impacts to private lands, the Crow Indian Reservation, state-owned lands, and federal lands controlled by BLM.

CBNG Development on Indian Reservations and the Ashland Ranger District

The development of CBNG resources on the Crow and Northern Cheyenne reservations and on the Ashland Ranger District is assumed to take place during the next 20 years and is therefore included in the cumulative effects analysis. The RFD estimated that 1,400 to 4,000 wells could be developed on each reservation and 50 to 200 wells on the Ashland Ranger District. The impacts associated with this development would be similar to the impacts described within each of the resource topics per alternative and adjusted for magnitude. Of course, the land disturbances, wildlife, cultural and paleontological, visual, social economic, recreational, air quality, soils, and special status species impacts described for those resources would be experienced on the reservations and on the Ranger District. The surface and groundwater quality impacts would be felt on the reservations and on the District but they would also contribute to changes in the watersheds into which the flow.

Tongue River Railroad

The Surface Transportation Board has published a Draft Supplemental Environmental Impact Statement for the Tongue River Railroad Company's (TRRC) proposed rail line construction in Custer, Rosebud and Big Horn Counties, Montana. The document specifically analyzes the proposed 17.3 mile "Western Alignment" route, which had been preceded by two related applications that were considered and approved by the Board in 1986 and 1996, respectively. The proposed Western Alignment is an alternative route for the southernmost portion of the 41-mile Ashland to Decker alignment; known as the Four Mile Creek Alternative. The proposed Western Alignment bypasses the Four Mile Creek alignment, which is generally located from the Birney Road (Hwy 566) and the Tongue River Canyon junction, running west to Hwy 314, then south to the Decker Mine. The Western Alignment would continue south along the Tongue River on the ridge, but paralleling the river and ending around the Spring Creek Mine area.

The Tongue River Railroad is a proposal to build a new rail system to support trains hauling coal along the Tongue River from Miles City to Decker, Montana. The TRRC was authorized to begin construction of the 117-mile railroad in 1996 by the Surface Transportation Board. Operations were scheduled to begin in 2001 but construction has not commenced and no projected start date is available. The rail system, if built, would consist of several spur lines connected to individual coal mines throughout the CBNG emphasis area. The total system would measure approximately 150 miles. Assuming an average 200-foot wide right-of-way, an estimated 3,600 acres would be disturbed by construction and operation activities within the planning areas.

The construction of this rail system would create numerous potential impacts, including socioeconomic issues for local towns along the route, alteration to ranch and grazing lands, reductions in air quality, impediments to Native American cultural sites, increased erosion along the Tongue River riparian areas, increased sedimentation loading in the Tongue River, introduction of noxious weeds, and increased obstructions to wildlife habitat. Specific impacts would be similar to impacts from other surface disturbing activities and emission sources. Details of potential impacts can be found in the EIS and SEIS prepared by the Surface Transportation Board. Mitigation measures would be included with agency permits.

Land Management Agency-Approved Natural Resource Mitigation Measures

Mitigation measures are restrictions on lease operations, which are intended to minimize or avoid impacts to resources or land uses from oil and gas activities. The mitigation measures listed in Table MIN-5 would be applied to permits, leases or approvals granted by the land management agency. The list is not all inclusive, but presents the mitigation measures most often used in the planning area. The wording of the mitigation measure may be modified or additional measures may be developed to address specific conditions. Mitigation measures would be included as appropriate to address site-specific concerns during all phases of CBNG development.

TABLE MIN-5
MITIGATION MEASURES THAT WOULD BE APPLIED AS APPROPRIATE TO MINIMIZE IMPACTS

Mitigation Measure	BLM	TLMD
Disturbed areas resulting from any construction will be seeded following the BLM seeding policy, state guidance or surface owner's requirements. Depending on surface ownership seeding is usually required during the fall or late spring.	X	
To the extent practicable, vegetation will be preserved and protected from construction operations and equipment except where clearing operations are required to conduct oil and gas operations, such as for roads, well pads, pipelines, power lines, utility lines, and structures. Clearing of vegetation will be restricted to the minimum area needed for construction and equipment.	X	
Temporary and permanent access roads will be avoided on south-facing slopes within big game winter range, where practicable.	X	
To the maximum extent practicable, all maintenance yards, field offices, and staging areas will be arranged to minimize disturbance to trees, shrubs, and other native vegetation.	X	
Topsoil removed by construction activities will be stockpiled for reclamation. Sensitive habitat areas will not be used for topsoil storage.	X	
The planting of grasses, forbs, trees, or shrubs beneficial to wildlife will follow the BLM seeding policy. When needed, BLM will require installation of erosion and sedimentation control measures, such as riprap, erosion mats, mulch, bales, dikes or water bars. Riprap material and placement must be approved by the appropriate agency.	X	
Erosion control and site restoration measures will be initiated as soon as a particular area is no longer needed for exploration, production, staging, or access. Disturbed areas will be recontoured to provide proper drainage.	X	
Topsoil piles may be required to be seeded following the BLM seeding policy.	X	
All above-ground electrical poles and lines will be raptor-proofed to avoid electrocution following the criteria and outlined in the Avian Power Line Interaction Committee (APLIC) (1994) and APLIC (1996). (APLIC 1994. Mitigating Bird Collisions with Power Lines: The State of the Art in 1994. Edison Electric Institute, Washington D.C. 78 pp.; APLIC 1996. Suggested Practices for Raptor Protection on Power Lines. Edison Electric Institute. Washington, D.C. 128 pp.).	X	

TABLE MIN-5
MITIGATION MEASURES THAT WOULD BE APPLIED AS APPROPRIATE TO MINIMIZE IMPACTS

Mitigation Measure	BLM	TLMD
Conduct three nesting habitat surveys for mountain plover in suitable habitat between May 1 and June 15. Surface use may be deleted in accordance with 43 CFR 3101.1-2.	X	
The Surface Management Agency is responsible for assuring that the leased lands are examined to determine if cultural resources are present and to specify mitigation measures. Guidance for application of this requirement can be found in NTL-MSO-85-1.	X	
Cuts and fills for new roads will be sloped to prevent erosion and to facilitate revegetation.	X	
It is the responsibility of the operator to control noxious weeds on lands disturbed in association with oil and gas lease operations. Lease-associated weed control strategies, when required by BLM, are to be coordinated with any involved surface owners and local weed control boards. A pesticide-use proposal must be prepared, and reviewed and approved by BLM prior to any herbicide application on lands disturbed by federal oil and gas lease operations. A pesticide application record must be within 24 hours after completion of application of herbicides. Additional measures may be required to prevent the spread of noxious weeds.	X	
Activities such as stream crossings that could directly impact sensitive or protected fish species will be undertaken during non-spawning periods for these species. In the unlikely event that multiple, sensitive, or protected fish species with back-to-back spawning periods are present in the same stream reach, one of the following options will be exercised. These options include selecting a nearby, alternative stream crossing site that does not provide suitable spawning habitat for the fish species of concern; using a nearby, existing stream crossing over the channel to avoid instream disturbances; or using shore-based equipment to position and extend the pipeline or other item (e.g., temporary bridge) across the stream, thereby avoiding in-channel activities.	X	
Operators must develop a Spill Prevention Control and Countermeasures plan to deal with accidental spills, the plan would include the strategic placement of berms and dikes.	X	
The road ditches would be flat bottomed and "V" ditches would not be allowed. Place water turn outs where appropriate to lessen the water impacts upon the ditches.	X	

TABLE MIN-5
MITIGATION MEASURES THAT WOULD BE APPLIED AS APPROPRIATE TO MINIMIZE IMPACTS

Mitigation Measure	BLM	TLMD
Prior to surface disturbance on slopes over 30 percent, an engineering/reclamation plan must be approved by the authorized officer. Such plan must demonstrate how the following will be accomplished: • Site productivity will be restored. • Surface runoff will be adequately controlled. • Off-site areas will be protected from accelerated erosion, such as rilling, gullying, piping, and mass wasting. • Water quality and quantity will be in conformance with state and Federal water quality laws. • Surface-disturbing activities will not be conducted during extended wet periods. • Construction will not be allowed when soils are frozen.	X	
Surface occupancy and use is prohibited within existing coal leases with approved mining plans.	X	
Surface occupancy and use is prohibited within riparian areas, 100-year flood plains of major rivers, and on water bodies and streams.	X	
Surface use is prohibited from December 1 to March 31 within crucial winter range for wildlife. This stipulation does not apply to the operation and maintenance of production facilities.	X	
Surface use is prohibited from April 1 to June 15 within established spring calving range for elk. This stipulation does not apply to the operation and maintenance of production facilities.	X	
Surface occupancy is prohibited in the designated Bighorn Sheep Range.	X	
Surface occupancy and use is prohibited within ¼ mile of grouse leks.	X	
Surface use is prohibited from March 1 to June 15 in grouse nesting habitat within 2 miles of a lek. This stipulation does not apply to the operation and maintenance of production facilities.	X	
Surface use is prohibited from March 1 – August 1, within ½ mile of raptor nest sites which have been active within the past 2 years. This stipulation does not apply to the operation and maintenance of production facilities.	X	
Surface occupancy and use is prohibited within ¼ mile of designated reservoirs and fisheries.	X	
The "Draft Guidelines for Oil and Gas Activities in Prairie Dog Ecosystems Managed for Black-footed ferret Recovery" (FWS, 1990) will be used as appropriate to develop site-specific conditions of approval to protect black-footed ferret reintroduction and recovery. Specific conditions of approval will depend on type and duration of proposed activity, proximity to occupied ferret habitat, and other site-specific conditions.	X	

**TABLE MIN-5
MITIGATION MEASURES THAT WOULD BE APPLIED
AS APPROPRIATE TO MINIMIZE IMPACTS**

Mitigation Measure	BLM	TLMD
Prior to surface disturbance, prairie dog colonies and complexes 80 acres or more in size will be examined to determine the absence or presence of black-footed ferrets. The findings of this examination may result in some restrictions to the operator's plans or may even preclude use and occupancy that would be in violation of the Endangered Species Act (ESA) of 1973. The lessee or operator may, at their own option, conduct an examination on the leased lands to determine if black-footed ferrets are present, or if the proposed activity would have an adverse effect, or if the area can be cleared. This examination must be done by or under the supervision of a qualified resource specialist approved by the Surface Management Agency (SMA). An acceptable report must be provided to the SMA documenting the presence or absence of black-footed ferrets and identifying the anticipated effects of the proposed action on the black-footed ferret and its habitat. This stipulation does not apply to the operation and maintenance of production facilities.	X	
Surface occupancy and use is prohibited within ½ mile of known bald eagle nest sites which have been active within the past 7 years and within bald eagle nesting habitat in riparian areas.	X	
Surface occupancy and use is prohibited within 1 mile of identified peregrine falcon nesting sites.	X	
Surface occupancy and use is prohibited within ½ mile of known ferruginous hawk nest sites which have been active within the past 2 years.	X	
Surface occupancy and use is prohibited within ¼ mile of wetlands identified as piping plover habitat.	X	
Surface occupancy and use is prohibited within ¼ mile of wetlands identified as interior least tern habitat.	X	
Surface occupancy and use is prohibited within sites or areas designated for conservation use, public use, or sociocultural use.	X	
Surface occupancy and use is prohibited within designated paleontological sites.	X	
Surface occupancy and use is prohibited within developed recreation areas and undeveloped recreation areas receiving concentrated public use.	X	
All surface-disturbing activities, semipermanent and permanent facilities in VRM Class II, areas may require special design, including location, painting, and camouflage, to blend with the natural surroundings and meet the visual quality objectives for the area.	X	
Geophysical exploration for oil and gas will not be allowed in the East Pryor Mountains, and Petroglyph Canyon areas of the Billings RMP area.	X	
Geophysical exploration for oil and gas will be allowed on designated roads and trails with restrictions in the Battle Butte, Finger Buttes, and Reynolds Battlefield areas of the Powder River RMP area.	X	

TABLE MIN-5
MITIGATION MEASURES THAT WOULD BE APPLIED AS APPROPRIATE TO MINIMIZE IMPACTS

Mitigation Measure	BLM	TLMD
Underground explosives for geophysical exploration for oil and gas exploration will not be allowed in the Bridger Fossil area of the Billings RMP area. Other geophysical exploration methods for oil and gas will be allowed at Bridger Fossil if the method will not damage the paleontology resource. If monitoring indicates fossil damage as a result of geophysical activity, it will no longer be allowed.	X	
Geophysical exploration for oil and gas will not be allowed on the significant cultural resource sites of the Castle Butte and Stark Site areas of the Billings RMP area. Geophysical exploration will be allowed (surface methods and vibroseis) in the remainder of the ACEC.	X	
In the sensitive plant areas of the Meeteetse Spires of the Billings RMP area, geophysical exploration for oil and gas will not be allowed by any method. On the remaining area of the Meeteetse Spires, geophysical exploration will be accessed by air only. Exploration will be shot holes and above-ground shots. Vibroseis will not be allowed.	X	
Lessee shall notify and obtain approval from the Department's Trust Land Management Division (TLMD) prior to constructing well pads, roads, power lines, and related facilities that may require surface disturbance on the tract. Lessee shall comply with any mitigation measures stipulated in TLMD's approval.		X
Prior to the drilling of any well, lessee shall send one copy of the well prognosis, including Form 22 "Application for Permit" to the Department's Trust Land Management Division (TLMD). After a well is drilled and completed, lessee shall send one copy of all logs run, Form 4A "Completion Report", and geologic report to TLMD. A copy of Form 2 "Sundry Notice and Report of Wells" or other appropriate Board of Oil and Gas Conservation form shall be sent to TLMD whenever any subsequent change in well status or operator, is intended or has occurred. Lessee shall also notify and obtain approval from the TLMD prior to plugging a well on the lease premises.		X
Issuance of this lease in no way commits the Land Board to approval of coal bed natural gas production on this lease. Any coal bed natural gas extraction wells would require subsequent review and approval by the board.		X
The TLMD will complete an initial review for cultural resources and, where applicable, paleontological resources of the area intended for disturbance and may require a resources inventory. Based on the results of the inventory, the TLMD may restrict surface activity for the purpose of protecting significant resources located on the lease premises.		X
The lessee shall be responsible for controlling any noxious weeds introduced by Lessee`s activity on State-owned land and shall prevent or eradicate the spread of those noxious weeds onto land adjoining the lease premises.		X
The lessee is responsible to pay for all damages, including penalties and charges assessed by the USDA-CFSA on CRP lands, as a result of drilling and production on the tract. All damages will be assessed by and paid directly to the TLMD.		X

TABLE MIN-5
MITIGATION MEASURES THAT WOULD BE APPLIED AS APPROPRIATE TO MINIMIZE IMPACTS

Mitigation Measure	BLM	TLMD
This lease includes areas that may be environmentally sensitive. Therefore, if the lessee intends to conduct any activities on the lease premises, the lessee shall submit to TLMD one copy of an Operating Plan or Amendment to an existing Operating Plan, describing in detail the proposed activities. No activities shall occur on the tract until the Operating Plan or Amendments have been approved in writing by the Director of the Department. TLMD shall review the Operating Plan or Amendment and notify the lessee if the Plan or Amendment is approved or disapproved.		X
After an opportunity for an informal hearing with the lessee, surface activity may be denied or restricted on all or portions of any tract if the Director determines in writing that the proposed surface activity will be detrimental to trust resources and therefore not in the best interests of the trust.		X
This tract contains navigable river beds. No surface occupancy is allowed within the bed of the navigable river, abandoned channels, or on islands and accretions. In addition, upon completion of a successful well, where river title is disputed, the lessee will file an interpleader action under Rule 22, M.R.Civ.P. in the Montana District Court in which the leased lands are located for all acreage within the lease in which the title is disputed. The lessee shall name all potential royalty claimants as defendants.		X
Lessee must contact the owner of the surface in writing at least 30 days prior to any surface activity. A copy of the correspondence shall be sent to TLMD.		X
No surface occupancy shall be allowed on this tract unless otherwise approved in writing by the Director of DNRC.		X
No surface occupancy shall be allowed on any portion of this tract which is indicated as right-of-way on the official highway plans on file at the Department of Transportation in Helena, Montana without prior written approval from TLMD.		X
It is the opinion of the TLMD that drainage is occurring on the land described in this lease and that if a well is not drilled within two years after this lease is issued the department will consider cancellation of the lease for failure to drill an offset well.		X
Prior to the cutting or removal of timber on these tracts for exploration or development related activities, the lessee shall acquire the approval of the appropriate TLMD area office.		X
To protect wildlife during periods important to their survival, surface occupancy or other activity shall be restricted from (date) through (date) of each year unless otherwise authorized in writing by the TLMD. Dates are determined on a case-by-case basis depending on the applicable species.		X
Potential wildlife conflicts have been identified for this tract. The TLMD will contact the Montana Department of Fish, Wildlife, and Parks office in the area for advice on alleviating any possible conflicts caused by lessee's proposed activities. Additional mitigation measures may be required.		X

TABLE MIN-5
MITIGATION MEASURES THAT WOULD BE APPLIED AS APPROPRIATE TO MINIMIZE IMPACTS

Mitigation Measure	BLM	TLMD
Potential wildlife conflicts have been identified for this tract. The TLMD will contact the U.S. Fish and Wildlife Service office in the area for advice on alleviating any possible conflicts caused by lessee's proposed activities. Additional mitigation measures may be required.		X
Wildlife species of concern have been identified on or near this tract. A survey in areas of proposed activity may be required prior to disturbance. Identified species will be avoided, unless otherwise authorized by the TLMD. Additional mitigation measures may also be required.		X
Any activity within 1/8 mile of the river, flood plain, or lake/reservoir on or adjacent to this tract must be approved in writing by the TLMD prior to commencement. No surface occupancy is allowed within the bed of the river, abandoned channels, the bed of the lake/reservoir, or on islands and accretions associated with the river or lake/reservoir.		X
No activity shall be allowed within 100 feet of any perennial or seasonal stream, pond, lake, prairie pothole, wetland, spring, reservoir, well, aqueduct, irrigation ditch, canal, or related facilities without prior approval of the TLMD.		X
Due to unstable soil conditions on this tract and/or steep topography, surface use may be restricted or denied. Seismic activity may be restricted to poltershots.		X
Due to existing surface uses (such as center pivots, wheel lines, etc.) development on this tract may be restricted.		X
Plant species of concern have been identified on or near this tract. A vegetation survey in areas of proposed activity will be required prior to disturbance. Identified rare plant species will be avoided, unless otherwise authorized by the TLMD.		X
A critical weed problem exists on this tract. Additional mitigation measures will be required to prevent further spread of noxious weeds. The department may require such measures as power washing of vehicles, car pooling, timing restrictions for seismic, etc. to facilitate this prevention.		X
This tract contains biological weed-control sites which must be avoided unless otherwise authorized by TLMD.		X
No surface occupancy of the cemetery site is permitted without written approval of TLMD.		X
Wooded areas on this tract will be avoided unless otherwise authorized by the TLMD.		X

MONITORING APPENDIX

MONITORING APPENDIX

Introduction

For each resource, a series of items will be monitored. Each item is evaluated by location, technique for data gathering, unit of measure, and frequency and duration of data gathering. When a duration is not specified, the duration is for the next 20 years. The monitoring plan states the event that will be evaluated and lists the key resources that will be monitored. If an adverse impact can be corrected by a management action within the scope of this plan, the change will be implemented. If the adverse impact can be corrected only by a management action that is outside the scope of this plan the Billings or Powder River Resource Management Plans (RMPs), the management change will be a formal amendment.

Under the phased development alternatives addressed in this SEIS resource based screens are used to phase development. The screens applicable to the preferred alternative (H) are described in detail in this section.

The Department of Natural Resources and Conservation (DNRC) Technical Advisory Committee (TAC) for the Powder River Basin Controlled Groundwater Area has proposed a groundwater monitoring plan for coal bed natural gas (CBNG) development. The monitoring recommendations are incorporated into the monitoring table. A complete copy of that plan is at the end of this appendix. Much of this plan has been adopted and put in place (see reports at http://www.mt.blm.gov/mcfo/cbng/CBNG-Monitoring.htm).

The Bureau of Land Management (BLM), Fish and Wildlife Service (FWS), and the State of Montana (state) have developed a wildlife monitoring and protection plan. It is located as an attachment to the Wildlife Appendix.

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Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
AIR QUALITY	Gaseous and particulate critical air pollutants	area-wide	air quality modeling and ambient air samples	$\mu g/m^3$ and parts per million concentrations as ($\mu g/m^3$)	hourly to 24 hr samples as per standards	predicted or measured exceedances of NAAQS and/or PSD increments by MDEQ	implement additional emission controls or operating limits
	Gaseous and particulate critical air pollutants	Birney/Ashland area	ambient air samples	$\mu g/m^3$ and parts per million concentrations as ($\mu g/m^3$)	hourly to 24 hr samples as per standards	before expanded development activity	implement additional emission controls or operating limits
	Gaseous and particulate critical air pollutants	area-wide	emission inventory	lbs/hr and tons/yr	annually	continuous	require submittal of annual reports
CLIMATE		areas affected by land disturbance	RAWS or COOP Stations	bulk precipitation	daily during the growing season	extremes affecting revegetation operations	
CULTURAL RESOURCES	Area of Critical Environmental Concern (ACECs)	area-wide	site inspection	site, surrounding area	annually	any noticeable trend indicating increased disturbance—natural or human-caused	increase frequency of monitoring to ensure ACEC values are not being impaired
	20% of National Register eligible sites	CBNG emphasis area	site inspection	site, surrounding area	annually	impacts to sites from unauthorized uses affecting qualities that make sites eligible for listing on National Register of Historic Places	halt activity affecting eligible sites. Increase monitoring of nearby eligible sites. Evaluate damage to sites.
	random sample of 50 sites	CBNG emphasis area	site inspection	site, surrounding area	annually	any noticeable trend indicating increased disturbance—natural or human-caused	increase frequency and number of sites monitored, if sites are being impacted by CBNG-related activities. Evaluate damage to sites.

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Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
HYDROLOGY	surface water quality and quantity	Regionally at the monitoring stations identified by the IWG (see 2005 report later in this appendix). Note that the 10% of 7Q10 criteria for untreated water will apply unless stations upstream and downstream from proposed outfalls are monitored	as determined by the IWG	as determined by the IWG	as determined by the IWG	exceedance of any parameter above the state of MT surface water quality standards, or the identified BLM thresholds	report exceedances to MDEQ, who will determine cause, and take appropriate actions If monitoring indicates that BLM thresholds have been met or exceeded untreated discharge of CBNG water from federal well will no longer be allowed upstream from that station. Previous approvals may be modified.
	groundwater drawdown	regionally at locations determined by the IWG (see TAC report later in this appendix)	monitoring wells would be finished in bedrock units; especially coal seams expected to be developed for CBNG.	depth to water reported in hundredths of feet	depth to water measurements will be made approximately monthly to establish an initial baseline. Measurements will be made approximately quarterly thereafter, unless a greater frequency is determined to be necessary. Monitoring will continue until at least 80% recovery of static water level has been achieved	a 20-foot decrease in static water level from seasonally adjusted mean static water level (determined from baseline data)	if falling water levels are determined to be caused by CBNG activity, operators must offer water well mitigation agreements to all landowners with water sources in the defined drawdown area (20 feet or greater drawdown) of their development. Hydrologic barriers, such as injection wells, may be an option in some cases to prevent drainage of Native American gas and water resources.

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Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
HYDROLOGY (con't)	groundwater quality and quantity	alluvial groundwater would be monitored in stream valleys topographically down gradient from CBNG surface discharge points Since discharge to ephemeral streams would not be allowed, these wells would be along larger streams.	monitoring wells would be finished in the alluvium. Depth to water measurements and water quality parameters, including but not limited to pH, EC, water temperature, common ions (Na, Mg, Ca, K, HCO_3, CI, SO_4), and would be obtained.	standard quantitative measurements of water quality and static water level (mg/l, °C, µS/cm, and hundredths of feet)	depth to water measurements will be made approximately monthly to establish an initial baseline. Depth to water will then be collected approximately quarterly thereafter. Water quality samples will be taken approximately annually, unless more frequent monitoring is needed. Monitoring will continue until at least 80% recovery of static water level has been achieved	A change in groundwater chemistry that affects its class of use Rise in static groundwater levels of 5-feet or more that may cause impacts at the ground surface	if impacts are determined to result from CBNG development, direct discharge of CBNG water into waterways in the watershed may be discontinued until modified Water Management Plans (WMPs) are submitted and approved
	groundwater quality and quantity	operators will install monitoring wells adjacent to impoundments	a monitoring well will be installed within the first permeable unit and within the first groundwater encountered, up to 50 feet total depth, to determine effectiveness of infiltration or if evaporation basins are leaking a water quality sample of the first groundwater (if encountered) will be collected to determine class of use.	depth to water (feet to water reported in hundredths of feet). Water quality samples will be collected if rises in groundwater are observed or if water is observed in a previously dry zone.	wells will be gauged monthly for the first year and quarterly thereafter unless a rise is observed. If a rise is observed monitoring will be monthly. Water quality samples will be collected whenever the water level is above baseline. Monitoring will continue at least until the end of CBNG water discharge into the impoundment	a rise of 1-foot or more in static water levels above seasonally adjusted mean water levels (determined from the first year of data) or a change in the class of use in the groundwater	Any change in class of use will be reported to MDEQ. Operators may be required to install additional monitoring wells further downgradient, or discharge into impoundments may be required to cease until a revised WMP is submitted and approved

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Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
HYDROLOGY (con't)	springs	a network of springs which are determined to be fed by the regional flow system will be identified along coal outcrops in the CBNG development area	spring discharge and water quality parameters, including but not limited to pH, EC, water temperature, common ions (Na, Mg, Ca, K, HCO_3, CI, SO_4), will be determined from existing springs	discharge (cfs), pH, EC (µS/cm), and water temperature (°C) will be determined in the field. Standard quantitative measurements of water quality also will be used (mg/l)	Field measurement of discharge, pH, EC, and water temperature will be determined approximately quarterly. An initial water quality sample will be collected; additional samples will be analyzed if substantial changes in the field parameters are observed.	a 50% decrease in spring discharge below seasonally adjusted mean (determined in the first 3 years), or a significant change in water quality that affects its beneficial use	if decreased spring discharges or water quality are determined to result from CBNG activity, operators must offer spring mitigation agreements to landowners who use the spring. If impacted spring is identified as important wildlife habitat, adaptive management practices will be used at the landscape level to improve spring ecosystems. Hydrologic barriers, such as injection wells, may be an option in some cases to prevent drainage of Native American gas and water resources.
INDIAN TRUST	groundwater	adjacent to the Northern Cheyenne and Crow reservations	sampling of dedicated monitoring wells in the zones of extraction and zones above and below the expected activity—wells are to be placed in the affected areas to areas unaffected by management activities	standard quantitative measurements of water quality—measurement of depth in feet	field measurements 6 times yearly prior to production activities, continue throughout the activity period and for the duration of 95% of the recovery of pre-development conditions	where site-specific studies show a potential to affect Reservation groundwater, the Tribe would be consulted as to appropriate protection measures and if continuous monitoring shows a drawdown of groundwater that is attributed to CBNG production	BLM would require the operators to modify federal CBNG production. Mitigation options include reducing production rates, shutting in the well or wells, establishing a hydrologic barrier, or providing compensation to the affected Tribe.

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Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
INDIAN TRUST (con't)			monitoring wells will be established near the mouth of streams that contain alluvium	measurements of depth in feet	water level measurements will be taken monthly prior to production activity and during the development - water quality measurements will be taken 4 times per year	a 20% rise in the water table above its seasonally adjusted elevation, or a 2 unit increase in the SAR value	Discontinuance of CBNG evaporative ponds in that watershed, or require ponds to be lined
	natural gas	area-wide	drainage evaluation	radius of drainage	as needed	gas drainage	a communitization agreement, requiring operators to reduce production rates, shut-in wells, change spacing, or establish a hydrologic barrier to protect the Indian minerals from drainage
LANDS AND REALTY	rights-of-way	area-wide	site inspection	right-of-way	minimum of once during or for construction within 2 years of issuance for MLA reviews and within 5 years of issuance for FLMPA reviews; then in the 20th year after issuance and every 10 years thereafter	nonuse of right-of-way or violation of right-of-way grant stipulations	require compliance with right-of-way grant stipulations with possible suspension and/or termination for noncompliance or nonuse
MINERALS **Oil and Gas**	Geophysical Notice of Intent (NOI)	area-wide	line or area inspection	operations conducted in compliance with NOI	minimum of once during operations	violation of regulations, change from approved Notice of Intent, unnecessary or undue degradation	require operator to follow NOI
	Geophysical Notice of Completion (NOC)	area-wide	line or area inspection	operations conducted in compliance with NOC	minimum of once during plugging, once after reclamation	violation of regulations, change from approved NOC unnecessary or undue degradation	require operator to correct violation

TABLE MON - 1

Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
MINERALS **Oil and Gas (con't)**	Application for Permit to Drill (APD)	area-wide	site inspection	operations conducted in compliance with Application for Permit to Drill	minimum of once and as necessary	violation of regulations, change from approved Application for Permit to Drill	issue an incidence of noncompliance (INC) with timeframe to correct or shut-in drilling operations
	Sundry Notice	area-wide	site inspection	operations conducted in compliance with Sundry Notice	as necessary	violation of regulations, change from approved Sundry Notice unnecessary or undue degradation	issue an INC with timeframe to correct
	natural gas	area-wide	drainage evaluation	radius of drainage	as needed	if gas drainage is occurring, there would be a communitization agreement, drilling of protective wells on federal lands, or different spacing, to protect the federal minerals from drainage	certified letter to lessee requiring protection, compensation royalty, relinquishment
	produced water disposal	area-wide	site inspection	operations conducted in compliance with permit	minimum of once annually or as necessary	violation of regulations, change from approved permit, unnecessary or undue degradation	issue an INC with timeframe to correct or shut-in operations
	spill	area-wide	site inspection	area cleaned up, reclaimed	minimum of once after event and as necessary	violation of regulations, change from approved permit, unnecessary or undue degradation	issue an INC and operator cleanup required
	plugged, abandoned wells	area-wide	site inspection	operations conducted in compliance with permit	minimum of once during operations	violation of regulations, change from approved permit, unnecessary or undue degradation	issue an INC correction required
	abandoned well reclamation	area-wide	site inspection	operations conducted in compliance with permit	minimum of once and as necessary until reclamation complete	violation of regulations, change from approved permit, unnecessary or undue degradation	issue an INC/certified letter requiring proper operator rehabilitation

TABLE MON - 1

Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
PALEONTOLOGY	significant paleontological localities, ACECs	area-wide	inspection of area disturbed	degradation caused by human or natural activities that lead to loss of significant fossil resources	once yearly	loss or damage to significant fossil resources	closure of areas surrounding site to prevent further disturbance to significant fossil resources
RECREATION	general recreation use	area-wide with emphasis on dispersed use of undeveloped recreation sites	area inspections to look for vandalism, resource abuse, and install photo points	site condition	biannual (June and October); photograph annually	user conflicts, resource degradation, or safety hazards	avoid location of oil and gas facilities in undeveloped recreation sites having concentrated use, and coordinate timing of exploration activities to minimize conflicts during peak periods of use
	concentrated recreation use	special recreation management areas, sites with recreation facilities	visitor registration, traffic counters estimates, photo points	visitor days, site condition	visitor registration boxes, counters checked once monthly at the minimum, weekly or biweekly during heavy use periods, photograph annually	increased visitor use per year or sustained use that requires additional or improved facilities	avoid location of oil and gas facilities in developed recreation sites having concentrated use, and coordinate timing of exploration activities to minimize conflicts during periods of use
		area-wide commercial, competitive activities	administrative review, site inspection for complexes with permit stipulations	permit stipulations, resource condition success of reclamation	on site during competitive events, periodic site inspection for commercial operations, administrative review annually	irreparable resource damage, compromise of visitor safety, recreation experience	avoid location of oil and gas facilities in areas where know commercially permitted recreation activities are occurring and coordinate timing of exploration activities to minimize conflicts during peak periods of use

TABLE MON - 1

Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
SOILS	soil erosion, uplands	area-wide where management activities are occurring or expected to occur	visual observation and surveyed erosion pins	soil loss in tons per acre	site will be visually examined quarterly. Where erosion is deemed excessive, measurements of site characteristics will be taken to determine rate of soil loss.	visual evidence of rill, gully, or sheet erosion. Loss of soil exceeding 10 tons per acre	report exceedance to BLM, MDEQ, or EPA. If caused by CBNG discharge or activities, enforcement action will be taken.
	soil erosion, streambank, and floodplain	area-wide along rivers and tributaries where management activities are occurring or expected to occur	visual observation and surveyed erosion pins	area effected in square feet or acres	site will be visually examined quarterly. Where streambank erosion is deemed excessive, measurements of site characteristics will be taken to determine soil loss.	a 10% increase in streambank loss	report exceedance to BLM, MDEQ, or EPA. If caused by CBNG discharge or activities, enforcement action will be taken.
	soil salinization	area-wide where management activities are occurring or expected to occur	visual observation, measurement of soil characteristics such as pH, EC, SAR	area effected in square feet or acres	site will be visually examined quarterly. Where salinity levels show an increase because of vegetation or soil effects, measurements of site characteristics will be taken to determine salinity levels.	a 20% increase in conductivity levels	report exceedance to BLM, MDEQ, or EPA. If caused by CBNG discharge or activities, enforcement action will be taken.
	compaction	areas effected by extraction activities	penetrometer or visual inspection	pounds per square inch	1 to 2 times yearly	10% increase in density	limit or block access to compacted sites

TABLE MON - 1

Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
VEGETATION							
	ecological status	areas affected by disturbance through the pre-production, production, post-production processes	ecological site method in key areas	composition, production compared to potential natural community for each site	pre-development ecological status baseline data	status is reduced by 15% or a drop in class	ecological site integrity will be altered to increase status of ecological site index by 15% or an increase in ecological class
	trend	areas affected by disturbance through the pre-production, production, post-production processes	any suitable methods as described in TR 4400-4 or the National Range Handbook	apply to the technique selected, may include number of individuals per unit area, percent cover, percent frequency, or percent species composition	every 3 to 5 years after the collection of ecological status baseline data	a change in the direction of trend away from management	measure implementation of action put forth to mitigate reduction of ecological status using techniques listed in monitoring appendix for vegetative trend
Noxious Weeds	trend	areas affected by disturbance through the pre-production, production, post-production processes	Montana Noxious Weed Standards	acres, plants per square feet, species	yearly (through post production reclamation)	10% increase beyond objectives for the area/new species occurrence or infestation	operators will be required to contain and suppress noxious weeds. Conservation measures will be required in noxious weed sites to decrease population of noxious weeds and increase population of native plant community
Riparian/ Wetlands	condition, trend, age class structure, streambank alteration	any federal action (including split estate)	photo plot, estimate key areas by sight inspection, Cole Browse Method, Key Forage Method, other methods found in Technical References (TR4400-3, TR4400-4, TR4400-7, TR1737-3, TR1737-8, TR1737-9) including MRWA (Montana Riparian Wetland Association) Riparian Inventory for areas not previously inventoried MRWA PFC on inventory areas	percent species composition, percent in each age class, percent utilization, height, percent of the streambank	based on activity plan schedule- a minimum of once every 5 years	trend away from objective or when no improvement occurs, in unsatisfactory habitat condition/functioning at risk with downward trend	oil and gas operators will be required to alter activities in order to provide environmental factors for increasing functionality or habitat conditions of the streams/wetlands. Oil and gas operators may be required to develop replacement wetlands in order to compensate for overall loss of wetlands according to Section 404 of Clean Water Act.

TABLE MON - 1

Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
Special Status and Threatened and Endangered (T&E) Plant Species	condition	areas affected by disturbance through the pre-production, production, post-production processes	Montana Natural Heritage Program and visual inspection	presence and condition	once during the growing season, at a minimum	downward trend in plant condition caused by oil and gas activities	oil and gas operators will be required to alter their activities in order to benefit environmental factors required by special status or T&E plant species
WILDLIFE (see also "Wildlife Appendix for the Programmatic Wildlife Monitoring and Protection Plan)							
Aquatic Biological Diversity (flora/fauna)	population diversity	intermittent/perennial streams associated with produced water discharge	stream sampling	diversity index	every 3 years	downward trend overall stream biological diversity	reduction or elimination of untreated produced water into drainage or watershed
Big Game	seasonal habitat use	project area plus 1-mile buffer	air/ground field inspection	occupancy	annually	downward trend in habitat occupancy	extension of timing stipulations or conditions of approval, off-site habitat management or enhancement
Black-footed Ferret	occupancy	prairie dog towns larger than 80 acres located within 0.5 mile of proposed activity	ground inspection	occupancy	determined on a site-specific basis in coordination with U.S. Fish and Wildlife Service (FWS)	habitat decline or prairie dog fatalities caused by oil and gas activities - occupancy of black-footed ferrets would be managed in a Black-Footed Ferret Management Plan	no incidental take; reinitiate consultation if new information shows it may be effected
Burrowing Owl	active nest locations	specific project area plus 0.5-mile buffer (within active prairie dog town)	ground inspection	occupancy	twice yearly (June to August)	human-caused disturbance to owls related to oil and gas activities such as vandalism and harassment	extension of timing and/or increase of distance from nest; stipulations or conditions of approval
Grey Wolf	occupancy	Billings RMP area	air/ground field surveys	number of sitings	annually until reintroduction objectives are met	1- to 3-year downward trend in production or occupancy	no incidental take; reinitiate consultation if new information shows it may be effected

TABLE MON - 1

Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
Migratory Non-game Birds	occupancy	project area plus 0.25-mile buffer	ground observations	occupancy	periodically	documented fatalities caused by oil and gas activities	refinements in infrastructure planning (project plans), implementation of travel corridors, enhanced reclamation standards, and off-site habitat management or enhancement
Mountain Plover	active nest locations	specific project area plus 0.5-mile buffer (within areas less than 4-inch average vegetation height and prairie dog towns)	ground inspection	occupancy	twice yearly (April 15 to June 30)	human-caused disturbance to mountain plovers related to oil and gas activities such as vandalism and harassment	BLM received an exemption from the prohibitions of Section 9 of ESA regarding take by agreeing to terms and conditions in biological opinion (BO). Incidental take of habitat and individuals allowed up to level stated in BO. Take must be monitored. Reinitiation of Section 7 will occur before allowable take is exceeded.
Prairie Dog	active prairie dog colony	specific project area plus 0.5-mile buffer	air/ground inspection	occupancy	annually	documented prairie dog fatalities caused by oil and gas activities	establishment of no surface occupancy zones and/or establishment of timing restrictions within prairie dog towns
Raptors	active nest locations (excluding burrowing owls)	project area plus 1-mile buffer	air/ground field inspection	number of nests	every 3 years	downward trend in occupancy	extension of timing and/or increase in distance from nest; stipulations or conditions of approval

TABLE MON - 1

Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
WILDLIFE **Raptors (con't)**	raptor productivity (including Burrowing owl)	active nests within 1-mile of project disturbance plus 1-mile buffer	air/ground field inspection	nest success/failure species productivity	annually	downward trend in nest success, overall productivity	extension of timing and/or increase in distance from nest; stipulations or conditions of approval
	raptor productivity-selected undeveloped comparison area	project area	air/ground field inspection	nest success/failure species productivity	every 5 years	information used as support to determine downward trend	extension of timing and/or increase in distance from nest; stipulations or conditions of approval
Sage Grouse	sage grouse lek location	CBNG overall project area	aerial field inspection	number, location of leks	every 5 years	downward trend in habitat occupancy	extension of timing and/or increase in distance from lek; stipulations or conditions of approval; off-site habitat management/mitigation
	sage grouse lek attendance	specific project development areas plus 2-mile buffer	air/ground field inspection	number of males/lek	annually	downward trend in lek attendance	extension of timing and/or increase in distance from lek; stipulations or conditions of approval; off-site habitat management/mitigation
	sage grouse winter habitat	project area plus 2 mi. buffer	air/ground field inspection	occupancy	annually	downward trend in habitat occupancy or quality caused by oil and gas activities	extension of timing and/or increase in distance from lek; stipulations or conditions of approval; off-site habitat management/mitigation

TABLE MON - 1

Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
Special Status Species (BLM and Montana Natural Heritage Program lists)	occupancy	specific project area plus 1-mile buffer	ground field inspection	occupancy	annually at a minimum via species habitat requirements	downward trend in habitat occupancy or quality caused by oil and gas activities	establishment of timing and/or distance from breeding area through stipulations or conditions or approval
Threatened, Endangered and Proposed Species other than previously described	occupancy, productivity	CBNG overall project area	air/ground field inspection	occupancy	determined on a site-specific basis in coordination with FWS	habitat decline or fatalities caused by oil and gas activities; occupancy of species would be managed in a site-specific Management Plan	reinitiate section and consultation with FWS

Prepared in cooperation with the Montana Department of Environmental Quality

Surface-Water Monitoring in Watersheds of the Powder River Basin, 2005

Powder River Basin Interagency Working Group

The Powder River Basin (PRB) is a geologic structural basin that contains an extensive natural gas resource associated with regional coal deposits. This coalbed natural gas (CBNG) is located beneath millions of acres of private and public land in southeastern Montana and northeastern Wyoming (fig. 1). The PRB Interagency Working Group (IWG) was established in June 2003 as a forum to identify, discuss, and find solutions to issues of common concern to government agencies involved in permitting and monitoring CBNG development. The PRB IWG is led by the Bureau of Land Management (BLM) and is composed of managers and technical staff from local, State, tribal, and federal government agencies with land management, conservation, or regulatory responsibilities in the PRB, as well as agencies like the U.S. Geological Survey (USGS) that provide technical support.

The mission of the PRB IWG is to: (1) provide for environmentally sound energy development, (2) develop coordinated and complementary best management practices, guidelines, and programs related to CBNG activities to conserve and protect resources, (3) monitor the impact of CBNG activities and assess the effectiveness of mitigating measures, (4) develop and integrate the databases and scientific studies needed for effective resource management and planning, and to make that information readily available, and (5) promote compatibility in the application of each agency's mission.

In order to more effectively address the technical issues presented by CBNG development, Task Groups that are staffed by technical specialists from the member agencies of the PRB IWG were formed to address specific resource issues. The Task Groups include Air, Aquatics, Water, and Wildlife. More information about the PRB IWG and Task Group activities is available at URL *http://www.wy.blm.gov/bfo/prbgroup/index.htm.*

Water Task Group

Substantial volumes of ground water are extracted from coalbeds in order to produce CBNG. The removal of ground water from aquifers and use or disposal of produced water on the surface have the potential to cause environmental impacts. One objective of the Water Task Group is to develop and implement monitoring plans for surface water and ground water at local and regional scales. This monitoring will help agencies make more informed decisions regarding CBNG permitting, and allow for dissemination of information to the public. This factsheet summarizes the surface-water-monitoring plan developed by the Water Task Group and describes the surface-water monitoring accomplished during 2005.

Surface-Water-Monitoring Plan

The surface-water-monitoring plan is a proposed sampling network that is generally composed of sites where PRB IWG member agencies have been conducting surface-water monitoring. Sampling sites may be located on mainstems or selected tributaries in each watershed (fig. 1, table 1). Proposed sampling frequencies vary with stream type and constituent class (table 2). The constituent classes recommended for monitoring include:

- Streamflow
- Field measurements—pH, dissolved oxygen, specific conductance, and temperature
- Major ions—dissolved calcium, magnesium, potassium, sodium, alkalinity, chloride, fluoride, sulfate, and silica; dissolved solids; and sodium-adsorption ratio
- Nutrients—total and dissolved nitrogen and phosphorus species
- Trace elements (primary)—total and dissolved aluminum, arsenic, barium, beryllium, iron, manganese, and selenium
- Trace elements (secondary)—total and dissolved cadmium, copper, chromium, lead, nickel, and zinc.
- Suspended sediment

U.S. Department of the Interior
U.S. Geological Survey

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Fact Sheet 2005–3137
December 2005

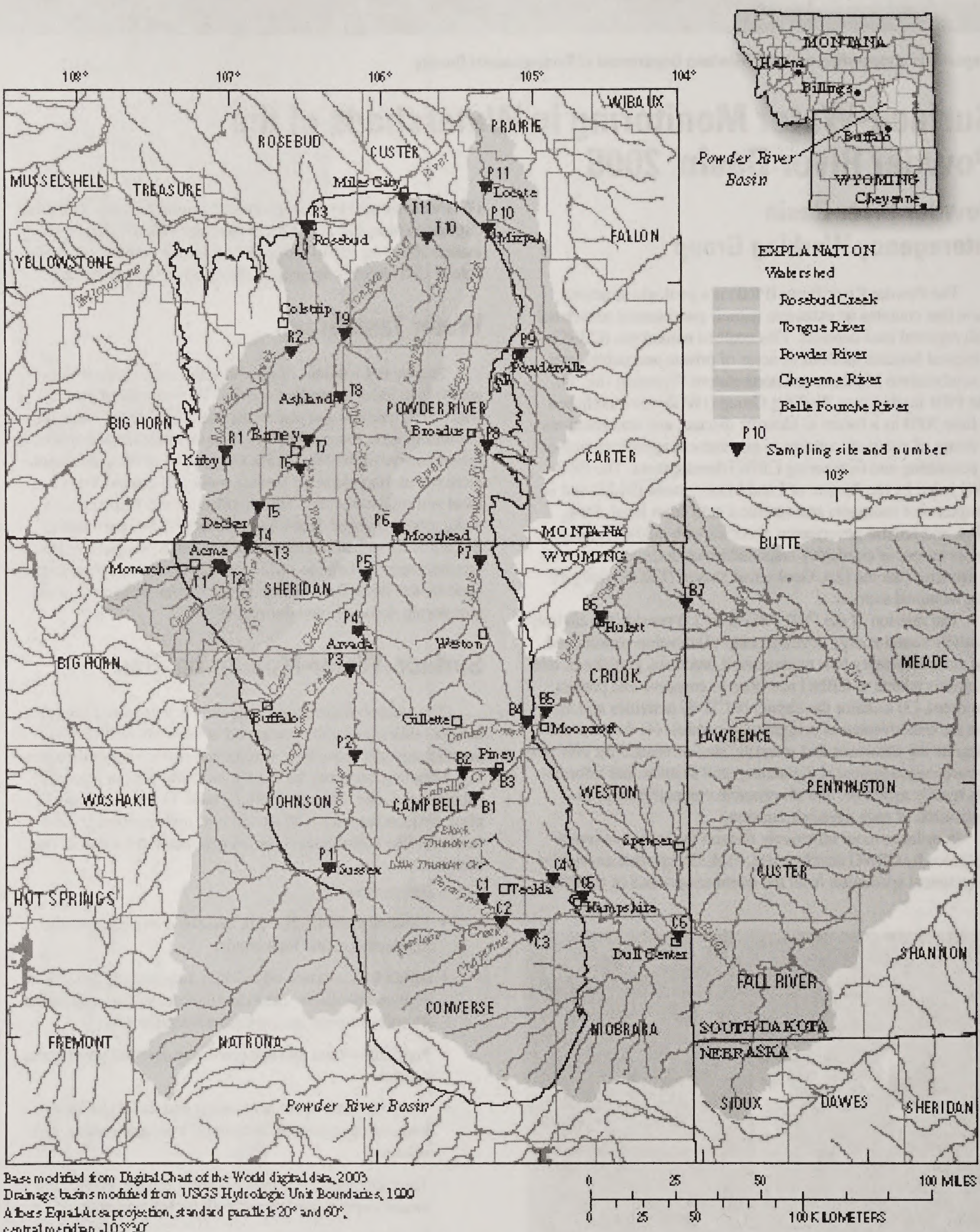


Figure 1. Location of sampling sites proposed in the Water Task Group's surface-water-monitoring plan for the Powder River Basin.

Table 1. Sampling sites proposed in the Water Task Group's surface-water-monitoring plan for the Powder River Basin.

Map number	U.S. Geological Survey site number	Site name	Stream type
R1	06295113	Rosebud Creek at reservation boundary near Kirby, Mont.	Mainstem
R2	06295250	Rosebud Creek near Colstrip, Mont.	Mainstem
R3	06296003	Rosebud Creek at mouth, near Rosebud, Mont.	Mainstem
T1	06299980	Tongue River at Monarch, Wyo.	Mainstem
T2	06305700	Goose Creek near Acme, Wyo.	Tributary
T3	06306250	Prairie Dog Creek near Acme, Wyo.	Tributary
T4	06306300	Tongue River at State line near Decker, Mont.	Mainstem
T5	06307500	Tongue River at Tongue River Dam, near Decker, Mont.	Mainstem
T6	06307600	Hanging Woman Creek near Birney, Mont.	Tributary
T7	06307616	Tongue River at Birney Day School Bridge, near Birney, Mont.	Mainstem
T8	06307740	Otter Creek at Ashland, Mont.	Tributary
T9	06307830	Tongue River below Brandenberg Bridge, near Ashland, Mont.	Mainstem
T10	06308400	Pumpkin Creek near Miles City, Mont.	Tributary
T11	06308500	Tongue River at Miles City, Mont.	Mainstem
P1	06313500	Powder River at Sussex, Wyo.	Mainstem
P2	06313605	Powder River below Burger Draw, near Buffalo, Wyo.	Mainstem
P3	06316400	Crazy Woman at Upper Station, near Arvada, Wyo.	Tributary
P4	06317000	Powder River at Arvada, Wyo.	Mainstem
P5	06324000	Clear Creek near Arvada, Wyo.	Tributary
P6	06324500	Powder River at Moorhead, Mont.	Mainstem
P7	06324970	Little Powder River above Dry Creek, near Weston, Wyo.	Tributary
P8	06325500	Little Powder River near Broadus, Mont.	Tributary
P9	06325650	Powder River near Powderville, Mont.	Mainstem
P10	06326300	Mizpah Creek near Mizpah, Mont.	Tributary
P11	06326500	Powder River near Locate, Mont.	Mainstem
C1	06364300	Porcupine Creek near Teckla, Wyo.	Tributary
C2	06364700	Antelope Creek near Teckla, Wyo.	Tributary
C3	06365900	Cheyenne River near Dull Center, Wyo.	Mainstem
C4	06375600	Little Thunder Creek near Hampshire, Wyo.	Tributary
C5	06376300	Black Thunder Creek near Hampshire, Wyo.	Tributary
C6	06386500	Cheyenne River near Spencer, Wyo.	Mainstem
B1	06425720	Belle Fourche River below Rattlesnake Creek near Piney, Wyo.	Mainstem
B2	06425800	Caballo Creek near Gillette, Wyo.	Tributary
B3	06425900	Caballo Creek at mouth, near Piney, Wyo.	Tributary
B4	06426400	Donkey Creek near Moorcroft, Wyo.	Tributary
B5	06426500	Belle Fourche River below Moorcroft, Wyo.	Mainstem
B6	06428050	Belle Fourche River below Hulett, Wyo.	Mainstem
B7	06428500	Belle Fourche River at Wyoming-South Dakota State line	Mainstem

Table 2. General sampling strategy proposed in the Water Task Group's surface-water-monitoring plan for the Powder River Basin.

Stream type	Sampling frequency	Constituent class
Mainstem	Continuous	Streamflow
	12 times per year	Field measurements
	12 times per year	Major ions
	2 times per year	Nutrients
	12 times per year	Trace elements, primary
	2 times per year	Trace elements, secondary
	12 times per year	Suspended sediment
Tributary	Continuous	Streamflow
	6 times per year	Field measurements
	6 times per year	Major ions
	2 times per year	Nutrients
	6 times per year	Trace elements, primary
	2 times per year	Trace elements, secondary
	6 times per year	Suspended sediment

Monitoring Summary, 2005

Because of funding shortfalls for surface-water monitoring, only part of the proposed sampling in the surface-water-monitoring plan was accomplished during 2005 (table 3). For the sites where the sampling was partially completed, either the sampling frequency was less than the proposed sampling frequency or not all of the constituent classes were analyzed. The Tongue River watershed was the only watershed where the sampling proposed in the surface-water-monitoring plan was fully completed.

Several of the agencies that participate on the PRB IWG contributed funding for monitoring and reporting, including:

- BLM,
- Montana Department of Environmental Quality,
- Montana Department of Natural Resources and Conservation,
- Northern Cheyenne Tribe,
- U.S. Environmental Protection Agency,
- USGS,
- Wyoming Department of Environmental Quality, and the
- Wyoming State Engineer's Office.

Streamflow data and water-quality samples were collected by USGS personnel using standard USGS field methods (*http://water.usgs.gov/owq/FieldManual/*). Samples were analyzed at the USGS National Water Quality Laboratory in Lakewood, Colorado.

Table 3. Monitoring accomplished for surface-water-monitoring plan during 2005.

[●, completed; ○, partially completed; and ○, not completed.]

Map number	Stream-flow	Field measure-ments	Major ions	Nutrients	Trace elements, primary	Trace elements, second-ary	Sus-pended sediment
R1	●	●	●	●	●	○	●
R2	●	○	○	○	○	○	○
R3	●	○	○	○	○	○	○
T1	●	●	●	●	●	●	●
T2	●	●	●	●	●	●	●
T3	●	●	●	●	●	●	●
T4	●	●	●	●	●	●	●
T5	●	●	●	●	●	●	●
T6	●	●	●	●	●	●	●
T7	●	●	●	●	●	●	●
T8	●	●	●	●	●	●	●
T9	●	●	●	●	●	●	●
T10	●	●	●	●	●	●	●
T11	●	●	●	●	●	●	●
P1	●	●	●	○	○	○	○
P2	○	●	●	○	○	○	○
P3	●	●	●	●	○	○	●
P4	●	●	●	○	○	○	○
P5	●	●	●	○	○	○	○
P6	●	●	●	●	●	●	●
P7	●	●	●	●	○	○	●
P8	○	●	●	●	●	●	●
P9	○	○	○	○	○	○	○
P10	○	○	○	○	○	○	○
P11	●	●	●	●	●	●	●
C1	●	●	●	○	○	○	○
C2	○	●	●	○	○	○	○
C3	●	●	●	○	○	○	○
C4	○	●	●	○	○	○	○
C5	○	●	●	○	○	○	○
C6	●	●	●	○	○	○	○
B1	○	●	●	○	○	○	○
B2	○	●	○	○	○	○	○
B3	○	●	●	○	○	○	○
B4	○	●	●	○	○	○	○
B5	●	●	●	●	○	○	○
B6	○	●	●	●	○	○	○
B7	●	○	○	○	○	○	○

Data Availability

Data collected as part of Water Task Group surface-water-monitoring plan are stored electronically in the USGS National Water Information System. Continuous streamflow and water-quality data are available to the public at URL: *http://waterdata.usgs.gov/nwis/*. Other USGS data for Montana and Wyoming can be accessed at *http://mt.water.usgs.gov/*, *http://tongueriver monitoring.cr.usgs.gov/*, and *http://wy.water.usgs.gov/*.

Future Work

Another objective of the Water Task Group is to interpret the surface-water-monitoring data that are collected. Until more data are collected, much of the initial interpretive analysis may focus on sites with historical data that were collected for previous monitoring programs. For example, the Powder River at Arvada, Wyoming has been sampled for many years, and relations between constituents, such as specific conductance and the sodium-adsorption ratio, have been established (fig. 2). If the monitoring data indicate that water quality is changing, managers can use adaptive management and appropriate mitigation measures to address environmental concerns.

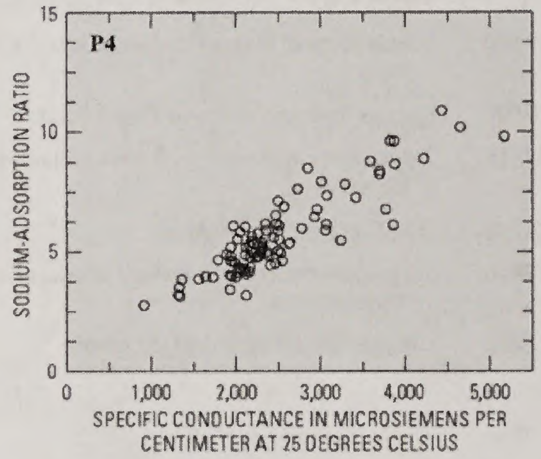
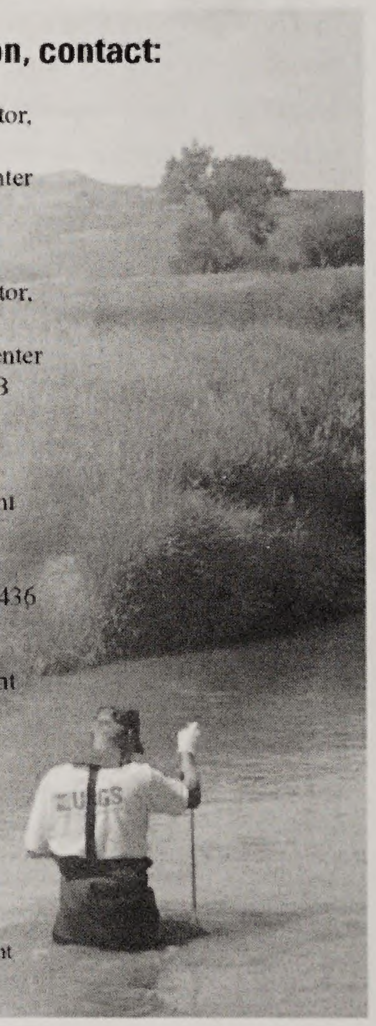


Figure 2. Specific conductance and sodium-adsorption ratio relation for the Powder River at Arvada, Wyo.

For more information, contact:



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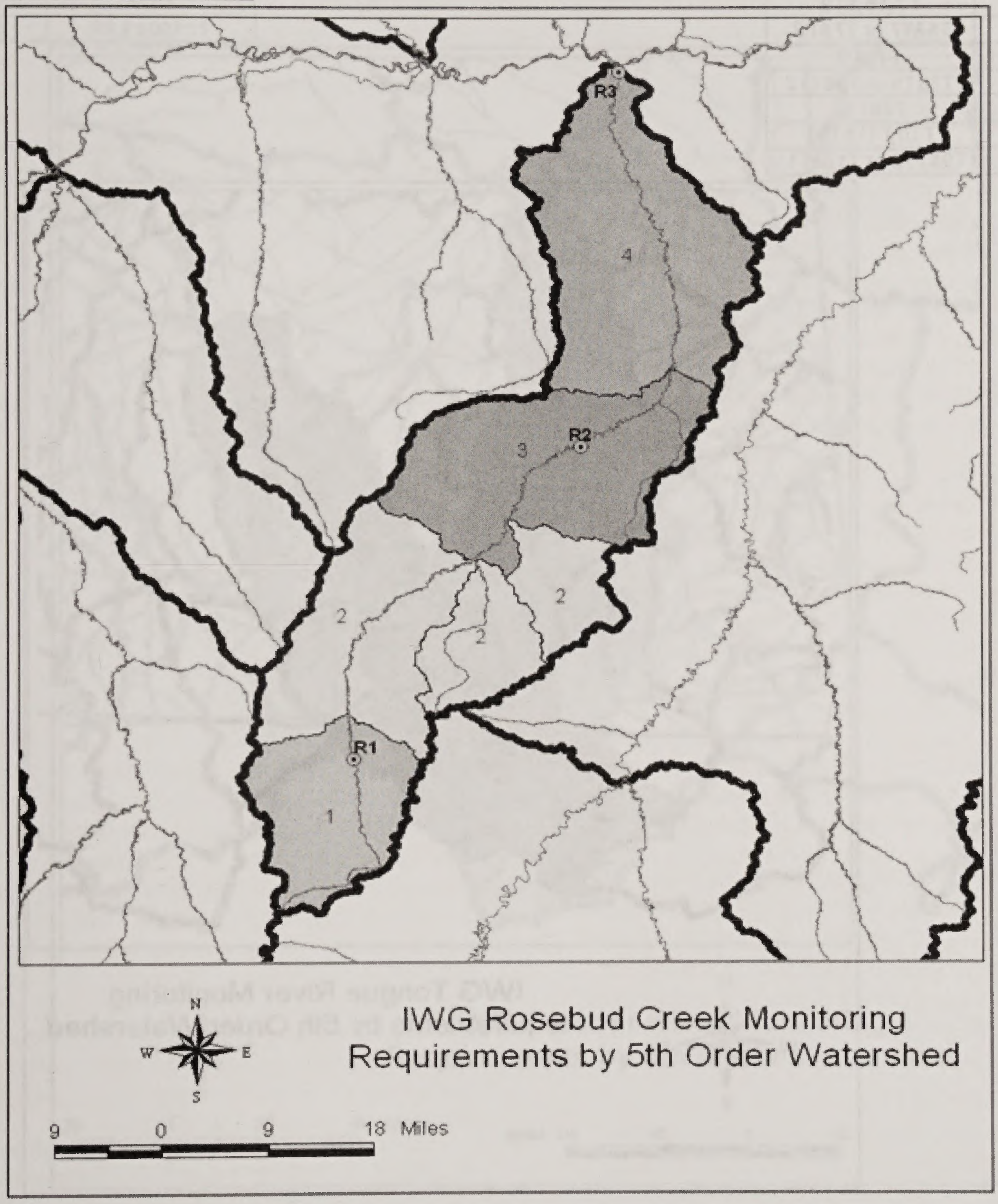
[2]Bureau of Land Management

Layout by Suzanne C. Roberts

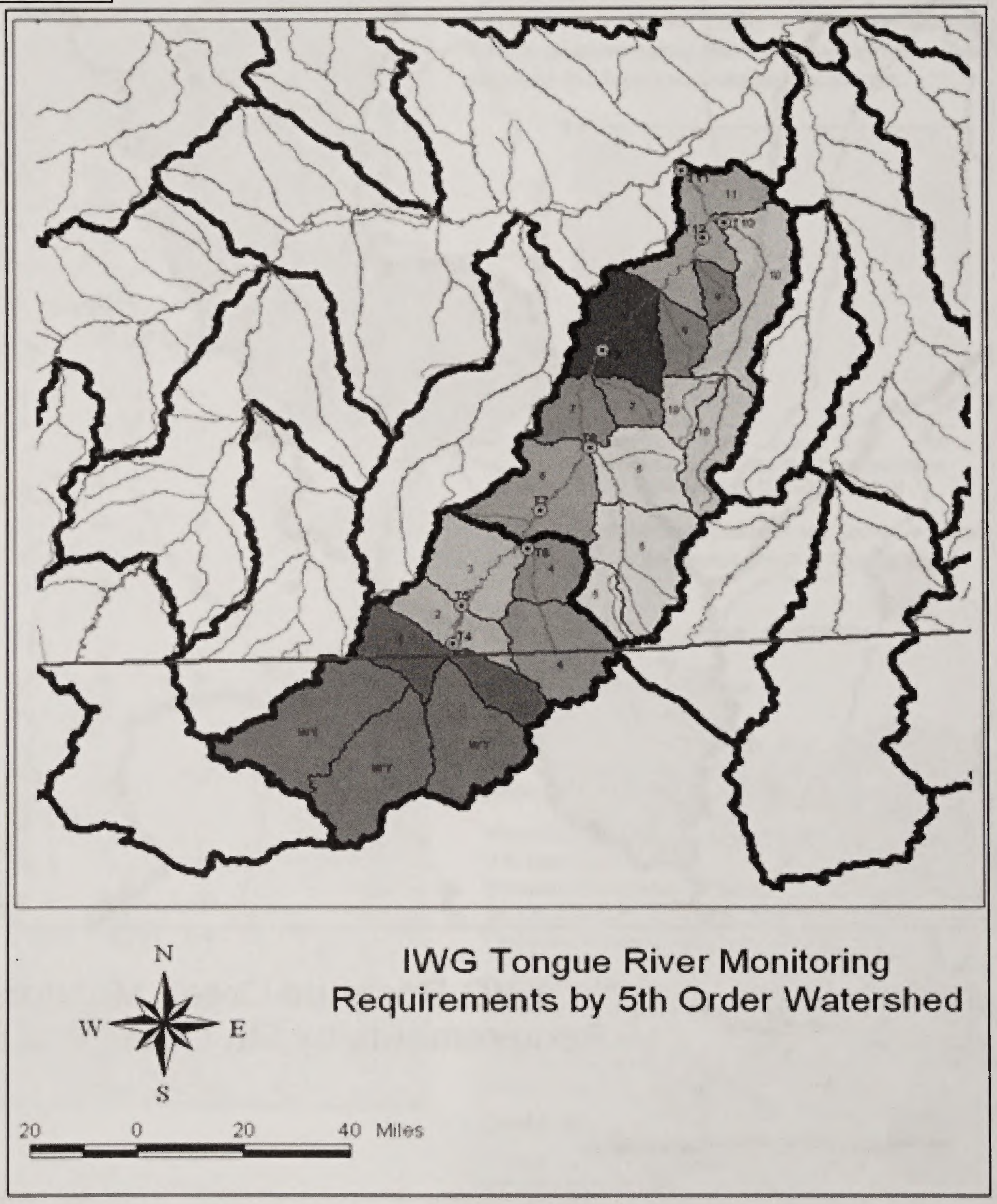
Rosebud

Group	Monitoring Required
1	R1 or R1&R2
2	R1&R2
3	R1&R2 or R2&R3
4	R2&R3



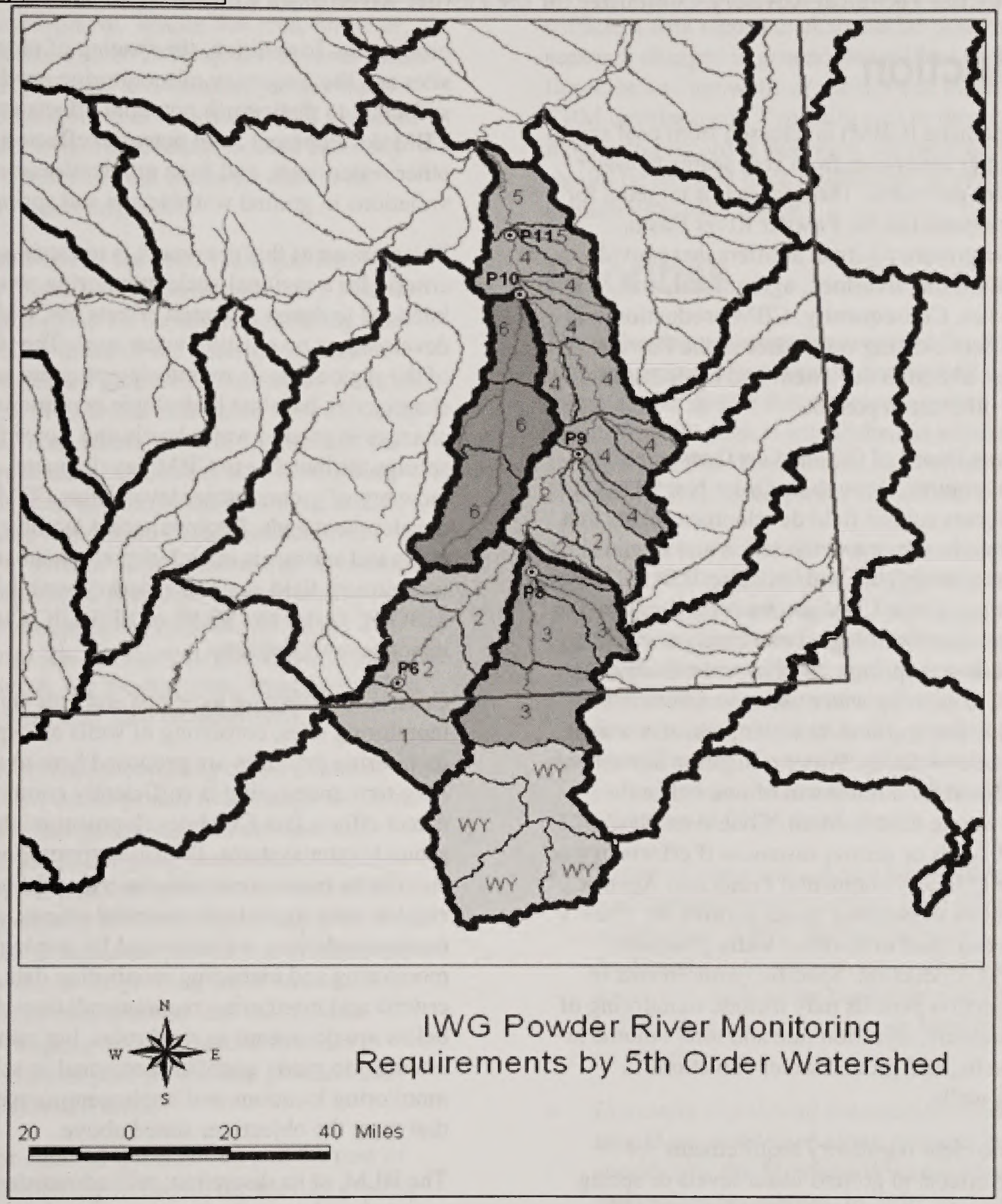
Tongue

Group	Monitoring Required
1	T4
2	T4&T5
3	T5&T7
4	T5,T6&T7
5	T7,T8,&T9
6	T5&T7 or T7&T9
7	T7&T8
8	T7&T9 or T9&T12
9	T9&T12
10	T10,T11&T12
11	T9&T12 or T12&T11



Powder

Group	Monitoring Required
1	P6
2	P6&P9
3	P6,P8&P9
4	P9&P11
5	None
6	P9,P10&P11



IWG Powder River Monitoring
Requirements by 5th Order Watershed

REGIONAL-SCALE MONITORING OF POTENTIAL EFFECTS OF COAL BED METHANE DEVELOPMENT ON WATER RESOURCES

Prepared by the Technical Advisory Committee for the Powder River Basin Controlled Groundwater Area

Introduction

Coal bed methane (CBM) is released from coal seams by pumping groundwater from coal seams to lower ground water pressures. The coal seams targeted for CBM development in the Powder River Basin constitute important regional aquifers that provide water for domestic, livestock, agricultural, and industrial uses. Consequently, CBM production will probably affect existing water uses in the Powder River Basin, although the extent and magnitude of effects are difficult to predict.

The Montana Board of Oil and Gas Conservation (MBOGC) requires, through its Order No. 99-99, that CBM producers submit field development plans that include groundwater characterization and monitoring. In addition to complying with existing MBOGC rules for wildcat gas wells, CBM producers are required to describe baseline hydrologic conditions, to inventory existing wells and springs, to offer water mitigation agreements to existing water users, and to monitor water production and shut-in water pressures within coal bed methane fields. Water mitigation agreements must be offered for a minimum of one-half mile (expanded to one mile in Mont. Code Ann. 85-2-521) from CBM fields or greater distances if effects extend father. The U.S. Environmental Protection Agency (EPA) requires monitoring under permits for Class V injection wells used to re-inject water produced during CBM production. Specific requirements of Class V injection permits may include monitoring of injection pressure, injection rate and total volume at injection wells, and ground water elevations in monitoring wells.

There are no clear regulatory requirements for monitoring effects to ground water levels or spring flows outside the one-mile minimum specified by MBOGC or the area affected by Class V injection wells. Groundwater monitoring conducted by CBM producers within and near CBM fields, as required by MBOGC or the U.S. EPA, will not reveal broad regional effects. Therefore, regional-scale monitoring needs to be conducted outside areas of potential CBM development to allow potential effects to be evaluated before, during, and after the period of CBM production. In addition, the spacing of monitoring sites and the frequency of monitoring needs to be sufficient to distinguish potential effects attributed to CBM development from potential effects attributed to other water users, and from ambient/seasonal variations in ground water levels and spring flows.

The purpose of this document is to establish design criteria for a regional-scale monitoring program intended to detect potential effects of CBM development on existing water uses. The objectives of the regional scale monitoring program are to characterize baseline hydrologic conditions, detect changes in ground water levels and flows from springs attributable to CBM development, and verify recovery of ground water levels after CBM development ends. Regional-scale monitoring of wells and springs is intended to augment and compliment field-scale monitoring established under MBOGC Order No. 99-99 or EPA UIC Class V injection well permits.

Criteria for selecting locations and spacing for monitoring sites, consisting of wells and springs, and monitoring practices are proposed here to ensure that long-term monitoring is sufficiently comprehensive to detect effects that CBM development might have on ground-water systems. Priorities are proposed to coordinate monitoring with the pace of development and the need to evaluate potential effects, and recommendations are presented for implementing monitoring and managing monitoring data. The criteria and monitoring recommendations described below are not meant as rigid rules, but rather are intended to guide qualified personnel in selecting monitoring locations and implementing monitoring that meet the objectives stated above.

The BLM, at its discretion, will administer the regional-scale monitoring program, while operators will be responsible for all in-field monitoring. The BLM has a commitment to maintaining the water monitoring of the PRB region, similar to their continued (25+ years) funding of the MBMG for coal mine water monitoring. The BLM will also partner with operators for in-field monitoring when federal gas is produced.

Criteria and Monitoring Practices

The portion of the Powder River Basin underlain by coals of the Tongue River Member of the Fort Union Formation is generally considered to have potential for CBM development. Within this area, however, CBM is less likely to be developed from coal seams with limited thickness and ambient ground water pressures; conditions that indicate limited potential for gas production. These areas, located primarily within 2 to 5 miles of coal outcrops, should be targeted for monitoring wells.

The Anderson-Dietz, Canyon, Wall, and Knobloch are the four primary coal seams within the Tongue River Member (Map 1). Separate monitoring sites located within 5 miles of the outcrops of each of these coal zones are proposed. Clusters of wells will be completed in different coal zones where outcrop areas overlap and, where present, springs will be monitored near each monitoring site. Monitoring wells will need to be completed in alluvial aquifers, in areas where water from CBM production is discharged to surface impoundments, or in selected sandstone aquifers within coal outcrop areas or CBM fields (when not required by MBOGC or the U.S. EPA). Springs that are current, historical, or potential sources of water but located away from established monitoring sites may also be monitored.

The focus of overall monitoring of the potential effects of CBM development will change as CBM fields mature, and gas production declines and eventually ends. Monitoring performed by CBM operators that is required by MBOGC or the U.S. EPA, will gradually be discontinued as portions and eventually all of fields are played out. Abandoned producing wells or monitoring wells within CBM fields should be incorporated into the regional monitoring program as field mature, in order to effectively monitor post-production groundwater recovery in affected areas.

The need for detailed information, and the cost of installing monitoring wells and monitoring ground water-levels and spring flows, will need to be balanced to determine the ultimate spacing between monitoring sites. At a minimum, one monitoring site will be located in every township that lies within 5 miles of the outcrop of a targeted coal. The ultimate spacing of monitoring sites might be greater, depending on site-specific conditions such as thickness of coal zone and importance of coal or sandstone aquifers, and priorities for monitoring outlined below.

Monitoring wells may be newly constructed wells, existing monitoring or water supply wells, or abandoned or transferred CBM production wells. Ground-water levels in monitoring wells and flows of springs will need to be measured monthly to obtain a sufficient data record to characterize patterns of seasonal changes in ground-water level or spring flows, before the wells or springs can be effected by CBM development. Typically two to three years of monitoring record is desirable. Monitoring frequency should be reduced once a sufficient record of baseline conditions is established.

Priorities

The following priorities are proposed for initiating monitoring and selecting monitoring well density and frequency, to ensure that a regional ground water monitoring program is established in advance of anticipated CBM development and before potential effects of CBM development can occur.

- *Sequence of CBM development*—Areas most likely to be affected by CBM development first are the highest priority for initiating monitoring. CBM development is expected to focus initially on the Anderson-Dietz coal zone and, therefore, monitoring near its outcrop should begin first. Records of exploration wells, pipeline plans, and identification of prospective coal zones can provide more specific information regarding the sequence of CBM development.

- *Extent of water use*—Areas where water from coal-beds is heavily used are high priorities for monitoring. Within the general area of the Anderson-Dietz outcrop, areas of concentrated water use, such as the headwaters of Otter Creek, will need immediate and more intensive monitoring.

- *Proximity to political boundaries*—Monitoring should be established along political boundaries, specifically the Montana-Wyoming border and reservation boundaries, in order to detect potential effects from areas outside the regional monitoring network.

- *Sensitivity or hydrogeologic setting*—More intensive monitoring will be necessary where faulting or complex stratigraphy result in complex hydrogeologic settings.

- *Existing monitoring networks*—Monitoring should be re-established at monitoring wells near operating coal mines and coal mining prospects studied in the past. New monitoring well construction should focus on areas where wells are not available.

- *Land or mineral ownership*—Monitoring should be conducted at sites with stable land and/or mineral ownership. For example, federally owned land, or other land with long-term access easements provide more reliable long-term access for monitoring.

Implementation and Data Management

An important goal of the proposed regional monitoring program is to ensure that all monitoring data collected are made readily accessible to the public. The regional monitoring program can, and probably will, be conducted by more than one agency, with funding from various sources. However, one agency or interagency will need to coordinate or review all regional monitoring activities in order to assure that monitoring occurs where needed and to prevent duplication. Data from field-scale monitoring pursuant to MBOGC Order 99-99 and EPA UIC Class V injection well permits will need to be managed similarly. A further responsibility of the lead agency or group should be to ensure that regional- and field-scale monitoring data are compiled and made available to the public in the Ground-Water Information Center (GWIC) and the National Resource Information Systems (NRIS).

Summary of Recommendations

A regional-scale monitoring program is necessary to characterize baseline hydrologic conditions, to detect potential effects resulting from CBM development, and to verify recovery of ground water levels after the period of CBM development. The following constitutes the main elements of a regional-scale monitoring program that should accomplish these objectives:

- Monitoring is needed to augment and compliment field-scale monitoring established under MBOGC Order No. 99-99 and EPA UIC Class V injection permits.

- Groundwater levels need to be measured in wells in coals and overlying or underlying sandstone aquifers at locations near coal outcrops outside of areas of prospective CBM development.

- Groundwater levels need to be measured in wells in alluvial aquifers in areas where water CBM production is discharged to surface impoundments, or selected sandstone aquifers within CBM fields.

- Flows from springs need to be monitored when they are near well monitoring sites or if they are important water sources.

- Groundwater levels need to be measured in abandoned or transferred CBM wells as CBM fields mature.

- Monitoring sites need to be located in every township near coal outcrops at a minimum.

- Groundwater levels in wells and flows from springs need to be measured monthly to characterize ambient seasonal patterns.

- Monitoring sites need to be established to ensure that the regional monitoring program is implemented in advance of localized CBM development and, consequently, that potential effects can be detected.

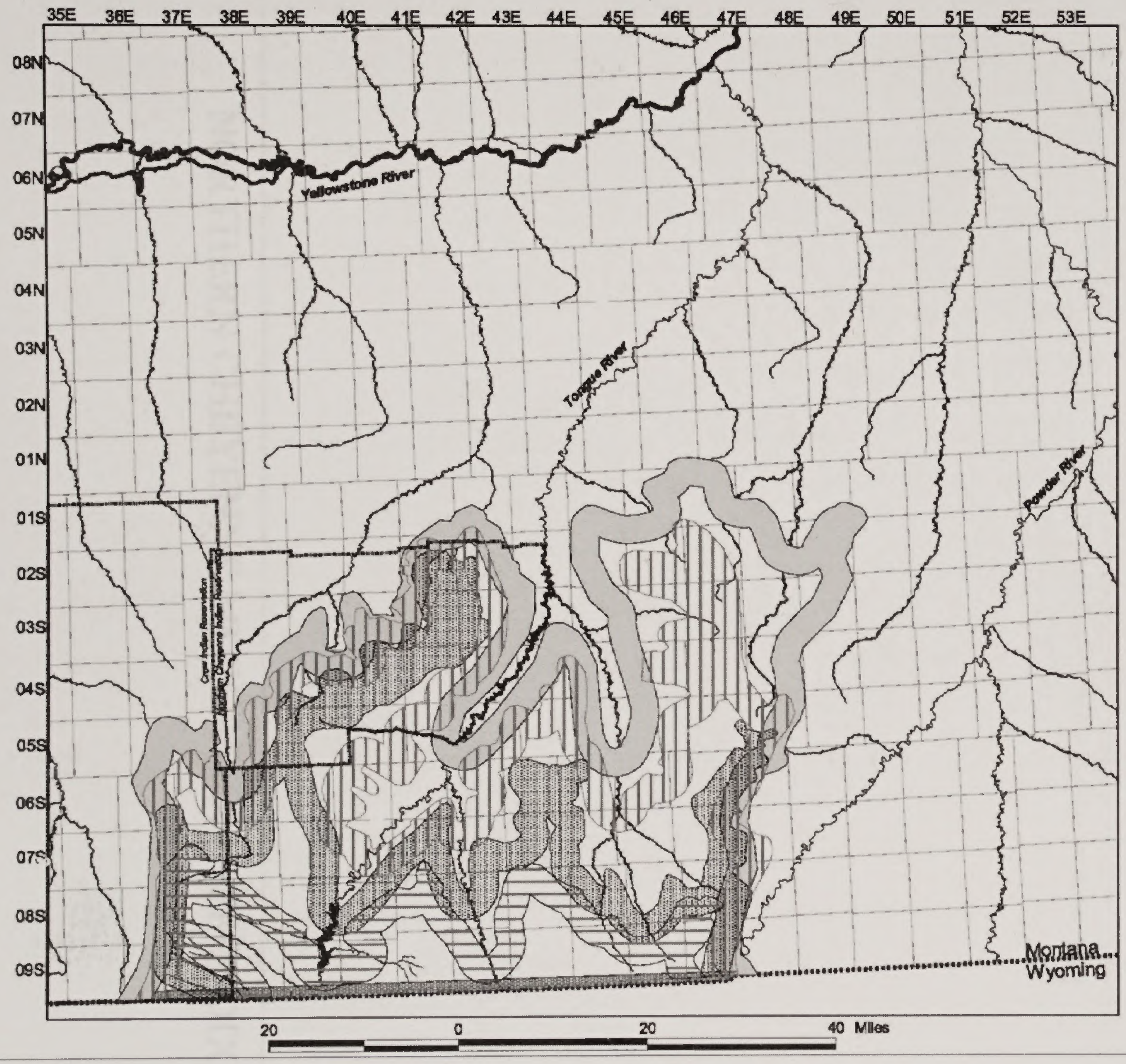
- One oversight agency or interagency group responsible for collecting and compiling comprehensive and consistent data should implement the proposed regional monitoring program.

- Monitoring data need to be compiled and made available to the public through GWIC and NRIS.

Monitoring Appendix Map 1.

Conceptual map showing recommended areas for a regional-scale coal-bed methane monitoring program

Montana Department of Natural Resources
Technical Advisory Committee for the Powder River Basin Controlled Ground-Water Area



Legend
- Anderson
- Canyon
- Wall
- Knobloch
- State-line monitoring area

This map is part of a report prepared by the Montana Department of Natural Resources, Technical Advisory Committee for the Powder River Basin controlled ground-water area, titled: Regional-scale monitoring of potential effects of coal bed methane development on water resources. The Technical Advisory Committee proposes a minimum of 1 monitoring site in each township within three - five miles of coal outcrops. In addition, monitoring is proposed near the Montana-Wyoming border.

The Anderson, Canyon, Wall and Knobloch coal seams are the four primary seams within the Tongue River Member of the Fort Union Formation in the Montana portion of the Powder River Basin. Shaded zones represent areas that are generally 3 miles or less from these respective coal outcrops. Separate ground-water monitoring sites are proposed within each of these coal zones to study the potential effects of coal-bed methane development. Actual site locations will be based on detailed geology and field conditions.

N

NORTHERN CHEYENNE MITIGATION APPENDIX

NORTHERN CHEYENNE MITIGATION APPENDIX

BLM meets its trust responsibility to protect American Indian trust resources and assets (trust resources) by first considering the potential impact of the proposed activity on identified trust resources. BLM then consults with the appropriate tribal government to obtain their comments on potential impacts to trust resources, along with possible protective measures. BLM considers the tribal government's comments and then determines what measures would be required to protect trust resources. BLM's decision has to consider, but not necessarily defer to, the comments of the tribal government on measures adequate to protect trust resources.

On August 13, 2002 the Northern Cheyenne Tribe proposed a series of mitigating measures for CBNG development under Alternative E, the preferred alternative for the Statewide document. A copy of the complete letter is available from the BLM. It is assumed that similar mitigation measures would be requested under Alternative H, and so they are addressed here. If different measures are submitted by the Northern Cheyenne, or any Native American Tribe, they will be similarly considered.

The left hand column of the following table contains the proposed mitigating measures. The center column contains the measures BLM planned to use to protect tribal trust resources, or other area resource values of importance to the Tribe under Alternative E. The right hand column addresses these measures under Alternative H.

These mitigating measures would be imposed on operators at the APD approval stage of development as needed on a case-by-case basis; or followed by BLM on a programmatic basis. The mitigation measures would only be applied on those lands/minerals where BLM has the authority. Some of the Tribe's mitigating measures do not have corresponding mitigation proposed by BLM due to limits in BLM authorities. Such instances are noted in the table and remain as mitigation options that may be undertaken by other agencies involved in the permitting process.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
Part I, Natural Resources: **A. Protection of Reservation Groundwater**		
1. *Buffer Zone.* An initial buffer zone of 14 miles will be maintained around the Northern Cheyenne Reservation exterior boundaries. This is the minimum necessary to assure that Reservation groundwaters are not adversely affected by off-Reservation CBNG development.	If proposed development of CBNG resources is located in aquifers with hydrologic connectivity to groundwater resources of the Northern Cheyenne Reservation, the following measures would be required: The operator[1] would be required to determine the potential for proposed field development[2] to affect Reservation groundwater when CBNG production is proposed. The 14-mile buffer zone proposed by the Northern Cheyenne Tribe would not be applied. This buffer zone is based on a theoretical maximum drawdown radius assuming uniform geologic and hydrologic conditions in a 2D model. Groundwater modeling that accounts for geologic faults, irregularities, and vertical leakage was prepared for the Final EIS. The modeling predicts a drawdown radius of 4 to 5 miles (in the Hanging Woman Creek drainage). These results more accurately represent anticipated site conditions and are consistent with the Montana Department of Natural Resources (DNRC) and Conservation, Water Resources Division, Technical Advisory Committee (TAC) recommended minimum of 3-miles. This recommendation is in the TAC's guidance document for meeting the requirements of the Montana Board of Oil and Gas Conservation (MBOGC) Order No. 99-99 that requires an evaluation of pre-development ground water conditions, plus monitoring and evaluations, including procedures for monitoring and reporting the effects of CBNG development on water users. Protection of Reservation groundwater would not rely on a buffer zone. Instead, the operator would be required to conduct geologic and hydrologic evaluations for CBNG production wells to be located in areas that may have hydrologic connectivity with Reservation groundwater. When the site-specific studies triggered by the aforementioned criteria determine there would be an effect to Reservation groundwater, the operator must develop and apply measures to prevent the impact of groundwater withdrawal and monitor the effectiveness of such measures.	If proposed development of CBNG resources is located in aquifers with hydrologic connectivity to groundwater resources of the Northern Cheyenne Reservation, the following measures would be required: The operator[1] would be required to determine the potential for proposed field development[2] to affect Reservation groundwater when CBNG production is proposed. The 14-mile buffer zone proposed by the Northern Cheyenne Tribe would not be applied. This buffer zone is based on a theoretical maximum drawdown radius assuming uniform geologic and hydrologic conditions in a 2D model. Groundwater modeling that accounts for geologic faults, irregularities, and vertical leakage was prepared for the Final EIS. The modeling predicts a drawdown radius of 4 to 5 miles. Groundwater monitoring to date indicates drawdown extending approximately 1.5 miles from production fields. For proposed federal CBNG development within 5 miles of the Northern Cheyenne and Crow Indian Reservations, the BLM, in consultation with the tribes, would require site-specific groundwater and air analyses. This groundwater analysis would also address CBNG drainage issues. The operator's analyses must demonstrate that the overall POD would be protective of Indian Trust, groundwater, CBNG, and air quality. If the analysis indicated that unacceptable levels of impairment to these resources would occur and could not be mitigated in consultation with the tribes, the BLM would not approve the APDs. Additional monitoring of groundwater and air may be required within this buffer to demonstrate model adequacy.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
2. *Groundwater Monitoring.* The BLM will not issue permits to drill within the 14-mile buffer zone until sufficient hydrological information exists to clearly and convincingly demonstrate that CBNG production closer to the Reservation will not cause drawdown of Reservation groundwater resources. Prior to and in the first years of CBNG development outside the 14-mile buffer zone, BLM will conduct intensive monitoring within the 14-mile buffer zone to generate site-specific information regarding local aquifer drawdown. Monitoring wells (nested piezometers) will be installed within the buffer zone on the order of at least one cluster per township. A cluster would include well screens in appropriate coal seams, overlying aquifers, and alluvial aquifers. More monitoring wells may be necessary as development increases in the basin and/or water-level declines are observed. The monitoring wells will be located on federal land or, if possible, on private or state land by negotiation. The wells will be installed as soon as possible before production begins to ensure that adequate baseline data is available (at least three years). Water-level measurements will be obtained from each cluster at least once a month. If declining water levels are observed through monthly data collection, a continuously recording data-logger will be installed in the monitoring well to more accurately determine changing water levels. The Tribe will be privy to the design and results of this groundwater monitoring program.	For CBNG wells located in aquifers with hydrologic connectivity to Reservation groundwater, the operator would be required to conduct a geologic and hydrologic evaluation prior to field development that identifies the potential for CBNG production to affect Reservation groundwater resources. CBNG project plans must include measures to prevent the impact of CBNG production on Reservation groundwater. When determined necessary by BLM, operators would be required to install monitoring wells to verify the effect of CBNG production on Reservation groundwater resources. Specific operator monitoring plans must include a hydrologic evaluation; describe the well location(s), aquifer(s) monitored, parameters monitored, baseline data acquisition, and response actions to adverse monitoring results. All groundwater monitoring data would become public information and made available to the Tribe. BLM may approve CBNG production upon completion of the geologic and hydrologic evaluation, and installation and equipping of any required monitoring wells.	See #1 above.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
3a. *Federal Development within Buffer Zone.* Groundwater modeling based on the site-specific information generated by the above intensive monitoring program will be used by BLM in consultation with the Tribe to determine, in clear and convincing fashion, whether and to what extent federal CBNG production can occur within the 14-mile buffer zone without causing drawdown of Reservation groundwater. At least five years of intensive monitoring of the effects of CBNG production outside the buffer zone will be required before making any decision on whether to proceed with development within the buffer zone. Such decision will be made in consultation with the Tribe.	Operators would be required to prepare site-specific analysis prior to field development to determine if federal CBNG production would affect Reservation groundwater. Where this analysis shows a potential to affect Reservation groundwater, the Tribe would be consulted as to appropriate protection measures. Operators would be required to monitor the impact of CBNG production on groundwater throughout the well life and after closure, if necessary.	Within 5 miles of the Northern Cheyenne and Crow Reservations, operators would be required to prepare site-specific analysis prior to field development to determine if federal CBNG production would affect Reservation groundwater. Where this analysis shows a potential to affect Reservation groundwater, the Tribe would be consulted as to appropriate protection measures. Operators would be required to monitor the impact of CBNG production on groundwater throughout the well life and after closure, if necessary.
3b. *Federal Development within Buffer Zone.* BLM will not issue permits to drill within the buffer zone until sufficient information exists to clearly and convincingly demonstrate that such production will have no adverse effect on Reservation aquifers. Any decision to proceed with drilling within the buffer zone will be made in consultation with the Tribe and consider the likely cumulative impacts from State-authorized production of CBMCBNG resources associated with State and private lands. Authorization of federal CBNG production within the buffer zone will begin with those tracts farthest from the Reservation that have the least potential to affect Reservation groundwater.	Operators would be required to provide an analysis of the hydrologic impact of CBNG production wells and identify any potential effect to Reservation groundwater resources. The Powder River Basin Controlled Groundwater Area standards would be applied by the state, to state and private leases, and would be enforced by BLM on federal leases. Where there is a potential for affecting Reservation groundwater, monitoring plans would be developed by the operator and approved by BLM in consultation with the Tribe. Site-specific analysis would determine the timing of CBNG production adjacent to the Reservation.	Operators would be required to provide an analysis of the hydrologic impact of CBNG production wells and identify any potential effect to Reservation groundwater resources. The Powder River Basin Controlled Groundwater Area standards would be applied by the state, to state and private leases, and would be enforced by BLM on federal leases. Where there is a potential for affecting Reservation groundwater, monitoring plans would be developed by the operator and approved by BLM in consultation with the Tribe. Site-specific analysis would determine the timing of CBNG production adjacent to the Reservation.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
3c. *Federal Development within Buffer Zone.* After commencement of production, monitoring of groundwater will be expanded to verify that CBNG production does not result in any drawdown of Reservation groundwater, all in consultation with the Tribe. Prior to production, monitoring wells (nested piezometers) will be installed along the northern and eastern boundaries of the Reservation on the order of at least one cluster (see # 2, above) per adjacent township. More wells may be necessary as development increases in the basin and/or water-level declines are observed. The wells will be installed as soon as possible before development to ensure that adequate baseline data is available (at least three years). Water-level measurements will be obtained from each cluster at least once a month. If declining water levels are observed through monthly data collection, a continuously recording data logger will be installed in the monitoring well to more accurately determine changing water levels.	Operators may be required to expand their monitoring plans as production continues if a decline in Reservation groundwater levels occurs that is attributable to their operations. Operators may be required to fund or install monitoring wells on Reservation lands in order to document impacts to Tribal resources. Monitoring wells placed on the Reservation would be subject to approval by the Tribal government. All results of groundwater monitoring would become public information. Regional monitoring wells, independent of specific operators, are currently being installed by the BLM and USGS. The USGS is installing 6 well clusters along the southern boundary of the Northern Cheyenne Reservation. The BLM is installing 9 well clusters throughout the PRB study area. These regional wells would assist in identifying groundwater drawdown impacts from CBNG development. The BLM plans to install additional monitoring wells in 2003 and 2004.	Monitoring of groundwater may be required within the buffer to demonstrate model adequacy. Operators may be required to expand their monitoring plans as production continues if a decline in Reservation groundwater levels occurs that is attributable to their operations. Operators may be required to fund or install monitoring wells on Reservation lands in order to document impacts to Tribal resources. Monitoring wells placed on the Reservation would be subject to approval by the Tribal government. All results of groundwater monitoring would become public information. A regional groundwater monitoring network is being implemented by the IWG (Northern Cheyenne, USGS, MBMG, FS and BLM) which includes 226 wells and 27 springs.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
4a. *State-Authorized Development within Buffer Zone.* If, prior to the decision to proceed with Federal development of CBNG resources within the 14-mile buffer, the State authorizes CBNG development within the buffer, the Federal government will act to protect the Tribe's groundwater resources by funding the on-Reservation groundwater monitoring outlined above.	BLM would continue to participate in programs to collect data from existing monitoring wells and install additional monitoring wells to provide for monitoring of impacts to Reservation groundwater levels.	BLM would continue to participate in programs to collect data from existing monitoring wells and install additional monitoring wells to provide for monitoring of impacts to Reservation groundwater levels.
4b. *State-Authorized Development within Buffer Zone.* Prior to any state-authorized CBNG development, the BLM and other federal agencies will assist the Tribe in negotiating and obtaining agreements with the State of Montana and private landowners to protect Tribal resources from such development. Such agreements may well require: (a) installation of a hydrologic barrier consisting of a series of wells between the Reservation and developing fields that inject water into the coal seam(s) to maintain the hydrostatic pressure in the formation and prevent the depletion of groundwater; (b) provision of alternative water supplies by drilling deeper wells or conveyance of water from locations not affected by CBNG development; and (c) compensation to the Tribe and its members for any accrued damage.	The BLM recognizes its responsibility to protect tribal trust resources and would take the appropriate action(s) on a case-by-case basis. The BLM would use all reasonable means to assure that Reservation groundwater is not adversely affected by off- Reservation CBNG development and that impacts to groundwater can be prevented.	The BLM recognizes its responsibility to protect tribal trust resources and would take the appropriate action(s) on a case-by-case basis. The BLM would use all reasonable means to assure that Reservation groundwater is not adversely affected by off- Reservation CBNG development and that impacts to groundwater can be prevented.
5a. *Remedies for Damage to Reservation Groundwater Resources.* If monitoring wells located along the Reservation boundary detect measurable water level declines from the baseline, BLM will immediately halt any federally authorized production within the buffer zone.	BLM would require operators to modify federal CBNG production if monitoring shows production is resulting in an effect to groundwater on the Reservation. BLM requirements could include reducing production rates, shutting in the well, or requiring the operator to provide compensation to the Tribe. The operator must mitigate the impact of groundwater withdrawal prior to resuming full production.	BLM would require operators to modify federal CBNG production if monitoring shows production is resulting in an effect to groundwater on the Reservation. BLM requirements could include reducing production rates, shutting in the well, or requiring the operator to provide compensation to the Tribe. The operator must mitigate the impact of groundwater withdrawal prior to resuming full production.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
5b. *Remedies for Damage to Reservation Groundwater Resources.* The United States will also take legal action on behalf of the Tribe (or fund legal action by the Tribe) to halt any State-authorized production that is causing such water level declines on the Reservation and to obtain compensation for all accrued damage to the Tribe and its members.	The BLM recognizes its responsibility to protect tribal trust resources and would take the appropriate action(s) on a case-by-case basis.	The BLM recognizes its responsibility to protect tribal trust resources and would take the appropriate action(s) on a case-by-case basis.
B. Protection of Reservation CBNG Resources		
1. *CBNG Monitoring.* The groundwater monitoring described in Section I.A. will also include close monitoring of hydrostatic pressure and analysis of CBNG drainage within the buffer zone.	BLM would use its existing regulations (43 CFR 3160) to require that operators provide the production data and analysis needed for BLM to determine if drainage of Reservation CBNG is occurring.	BLM would use its existing regulations (43 CFR 3160) to require that operators provide the production data and analysis needed for BLM to determine if drainage of Reservation CBNG is occurring. The additional groundwater analysis and monitoring required within the 5-mile buffer would also assist in the analysis of the potential for Tribal CBNG drainage.
2a. *Federal Development within Buffer Zone.* BLM will not issue permits to drill within the 14-mile buffer zone until sufficient information exists to clearly and convincingly demonstrate that CBNG production will not drain Reservation methane resources. Any decision to proceed with production within the buffer zone will be made in consultation with the Tribe and consider the likely cumulative impacts on Reservation CBNG reserves from state-authorized production of state and private CBNG resources.	The BLM has a responsibility to use reasonable means to prevent drainage of Reservation CBNG from extraction on federal lands. Operators would be required to provide an analysis prior to field development in areas of potential drainage of Reservation CBNG resources. In this analysis, operators must demonstrate that CBNG production would not be likely to drain Reservation CBNG resources.	The BLM has a responsibility to use reasonable means to prevent drainage of Reservation CBNG from extraction on federal lands. Operators would be required to provide an analysis prior to field development in areas of potential drainage of Reservation CBNG resources. In this analysis, operators must demonstrate that CBNG production would not be likely to drain Reservation CBNG resources. The additional groundwater analysis and monitoring required within the 5-mile buffer would also assist in the analysis of the potential for Tribal CBNG drainage.
2b. *Federal Development within Buffer Zone.* At least five years intensive monitoring of CBNG drainage from CBNG production outside the buffer zone will be required before any decision to proceed with development within the buffer zone.	Specific evaluations would be required for CBNG wells drilled in areas that could potentially drain Reservation CBNG. Such evaluations would include modeling of CBNG reservoirs to calculate the potential for drainage of Reservation CBNG. All evaluations would be made available to the Tribe.	Specific evaluations would be required for CBNG wells drilled in areas that could potentially drain Reservation CBNG. Such evaluations would include modeling of CBNG reservoirs to calculate the potential for drainage of Reservation CBNG. All evaluations would be made available to the Tribe. The additional groundwater analysis and monitoring required within the 5-mile buffer would also assist in the analysis of the potential for Tribal CBNG drainage.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
2c. *Federal Development within Buffer Zone.* Authorization of federal CBNG production within the buffer zone will begin with those tracts farthest from the Reservation that have the least potential to drain Reservation CBNG resources.	Operators would be required to provide analysis prior to field development to determine whether and to what extent federal CBNG production would drain Reservation CBNG. The analysis would be used by BLM to determine the timing of CBNG production adjacent to the Reservation boundary in order to protect Reservation CBNG resources from drainage.	Operators would be required to provide analysis prior to field development to determine whether and to what extent federal CBNG production would drain Reservation CBNG. The analysis would be used by BLM to determine the timing of CBNG production adjacent to the Reservation boundary in order to protect Reservation CBNG resources from drainage. The additional groundwater analysis and monitoring required within the 5-mile buffer would also assist in the analysis of the potential for Tribal CBNG drainage.
2d. *Federal Development within Buffer Zone.* After commencement of production, CBNG drainage monitoring will be implemented along the Reservation boundary as provided in Section I.A. above to verify that CBNG production does not result in any drainage of Reservation methane resources.	Operators may be required to provide updated information for reservoir modeling during production in order to monitor the potential for drainage of CBNG resources from the Reservation.	Operators may be required to provide updated information for reservoir modeling during production in order to monitor the potential for drainage of CBNG resources from the Reservation. The additional groundwater analysis and monitoring required within the 5-mile buffer would also assist in the analysis of the potential for Tribal CBNG drainage.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
3a. *State-Authorized CBNG Development within Buffer Zone.* If prior to the decision to proceed with federal development CBNG resources within the 14-mile buffer, the state authorizes CBNG development within the buffer, BLM and other federal agencies will protect the Tribe's CBNG resource by funding a full characterization of Reservation CBNG resources and on-Reservation monitoring of CBNG drainage.	The BLM recognizes its responsibility to protect tribal trust resources and would take the appropriate action(s) on a case-by-case basis. The BLM and the Technical Advisory Committee (TAC) are developing a regional monitoring program. Part of BLM's program during the first year of groundwater monitoring includes drilling, equipping, and testing monitoring wells adjacent to the Crow and Northern Cheyenne Reservations. The intent of the monitoring is to establish baseline data in advance of development and to determine if there are CBNG impacts to Tribal resources. The Tribe, through its efforts with the USGS, would also have baseline data through its current drilling efforts. The USGS is installing 6 monitoring well clusters along the southern Reservation boundary. The Tribe could participate as a member of the TAC in order to be involved in the process and provide recommendations for mitigation measures. The guidance document developed by the TAC within the Powder River Basin Controlled Ground Water Area (PRBCGA) would assist CBNG operators in complying with the technical requirements described in the PRBCGA Final Order and Montana Board of Oil and Gas Conservation Order No. 99-99. The PRBCGA Final Order identifies essential elements necessary for detecting and mitigating impacts from CBNG development that needs to be addressed for groundwater characterization and monitoring plans. The BLM monitoring wells are being installed in nine clusters distributed throughout the PRB, with well clusters near the southern boundary of the Northern Cheyenne Reservation in the Bull Creek and Dale Creek drainages. The BLM plans to install additional monitoring wells in 2003 and 2004.	The BLM recognizes its responsibility to protect tribal trust resources and would take the appropriate action(s) on a case-by-case basis. The Water Interagency Working Group has developed a regional monitoring program. The intent of the monitoring is to establish baseline data in advance of development and to determine if there are CBNG impacts. The Tribe, through its efforts with the USGS, also has baseline data through its current drilling efforts. The guidance document developed by the TAC within the Powder River Basin Controlled Ground Water Area (PRBCGA) would assist CBNG operators in complying with the technical requirements described in the PRBCGA Final Order and Montana Board of Oil and Gas Conservation Order No. 99-99. The PRBCGA Final Order identifies essential elements necessary for detecting and mitigating impacts from CBNG development that needs to be addressed for groundwater characterization and monitoring plans. This regional monitoring of groundwater would assist in the analysis of the potential for Tribal CBNG drainage.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
3b. *State-Authorized CBNG Development within Buffer Zone.* Prior to any state-authorized CBNG development within the 14-mile buffer zone, the BLM and other federal agencies will assist the Tribe in negotiating and obtaining agreements with the State of Montana and private landowners to protect Reservation CBNG resources. Such agreements may well require: (a) installation of a hydrologic barrier consisting of a series of wells between the Reservation and developing fields that inject water into the coal seam(s) to maintain the hydrostatic pressure in the formation and prevent the drainage of CBNG, and (b) financial compensation to the Tribe or Tribal allottees for any CBNG drained from Reservation lands and any other associated damage.	The BLM recognizes its responsibility to protect tribal trust resources and would take the appropriate action(s) on a case-by-case basis. In order to protect the correlative rights of the Tribe, the BLM would represent the Tribe at Montana Board of Oil and Gas Conservation (MBOGC) hearings that set spacing units for the production of CBNG resources, including state and private lands. The BLM would work with the MBOGC under its existing Memorandum of Understanding to protect Tribal resources that may be affected by state or private permits or establishment of CBNG spacing units adjacent to Tribal resources. In addition, the BLM, as a member of the technical advisory committee administered by the DNRC Water Management Division, would make recommendations to the MBOGC on the Tribe's behalf regarding monitoring requirements and mitigation of impacts.	The BLM recognizes its responsibility to protect tribal trust resources and would take the appropriate action(s) on a case-by-case basis. In order to protect the correlative rights of the Tribe, the BLM would represent the Tribe at Montana Board of Oil and Gas Conservation (MBOGC) hearings that set spacing units for the production of CBNG resources, including state and private lands. The BLM would work with the MBOGC under its existing Memorandum of Understanding to protect Tribal resources that may be affected by state or private permits or establishment of CBNG spacing units adjacent to Tribal resources. In addition, the BLM, as a member of the technical advisory committee administered by the DNRC Water Management Division, would make recommendations to the MBOGC on the Tribe's behalf regarding monitoring requirements and mitigation of impacts.

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4a. *Remedies for Damage to CBNG Resource.* If monitoring wells located along the Reservation boundary detect CBNG drainage, BLM will immediately halt any federally authorized production within the 14-mile buffer zone.	The interests of the Tribe would be considered prior to authorization of Federal production that may potentially drain Reservation CBNG resources. In establishing well spacing on Federal lands, protection against drainage of Reservation CBNG resources would be a priority. If monitoring or reservoir modeling indicates drainage of CBNG resources is occurring, the BLM would enter negotiations with the operator and the Tribe to protect the correlative rights of the Tribe. BLM requirements could include reducing production rates, shutting in the well, establishment of communitization agreements, or requiring the operator to pay compensatory royalty.	The interests of the Tribe would be considered prior to authorization of Federal production that may potentially drain Reservation CBNG resources. For proposed federal CBNG development within 5 miles of the Northern Cheyenne and Crow Indian Reservations, the BLM, in consultation with the tribes, would require site-specific groundwater and air analyses. The operator's analyses must demonstrate that the overall POD would be protective of Indian Trust, groundwater, CBNG, and air quality. If the analysis indicated that unacceptable levels of impairment to these resources would occur and could not be mitigated in consultation with the tribes, the BLM would not approve the APDs. In establishing well spacing on Federal lands, protection against drainage of Reservation CBNG resources would be a priority. If monitoring or reservoir modeling indicates drainage of CBNG resources is occurring, the BLM would enter negotiations with the operator and the Tribe to protect the correlative rights of the Tribe. BLM requirements could include reducing production rates, shutting in the well, establishment of communitization agreements, or requiring the operator to pay compensatory royalty.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
4b. *Remedies for Damage to CBNG Resource.* The United States will take legal action on the Tribe's behalf (or fund legal action by the Tribe) to halt any state-authorized production that is found to be draining CBNG resources from the Northern Cheyenne Reservation and to obtain compensation for all accrued damage to the Tribe and its members.	The BLM recognizes its responsibility to protect tribal trust resources and would take the appropriate action(s) on a case-by-case basis. To protect the correlative rights of the Tribe, the BLM would represent the Tribe at the MBOGC hearings that set well spacing for production of CBNG resources on state and private lands. The BLM will work with the MBOGC under its existing MOU to protect Tribal resources that may be affected by approval of state or private permits or establishment of CBNG well spacing units adjacent to Tribal resources.	The BLM recognizes its responsibility to protect tribal trust resources and would take the appropriate action(s) on a case-by-case basis. For proposed federal CBNG development within 5 miles of the Northern Cheyenne and Crow Indian Reservations, the BLM, in consultation with the tribes, would require site-specific groundwater and air analyses. The operator's analyses must demonstrate that the overall POD would be protective of Indian Trust, groundwater, CBNG, and air quality. If the analysis indicated that unacceptable levels of impairment to these resources would occur and could not be mitigated in consultation with the tribes, the BLM would not approve the APDs. To protect the correlative rights of the Tribe, the BLM would represent the Tribe at the MBOGC hearings that set well spacing for production of CBNG resources on state and private lands. The BLM will work with the MBOGC under its existing MOU to protect Tribal resources that may be affected by approval of state or private permits or establishment of CBNG well spacing units adjacent to Tribal resources.
5. *Northern Cheyenne Involvement in Monitoring and Analysis.* Training and employment will be provided to qualified and available Tribal members to involve them, to the fullest extent feasible, in all programs set forth in this Mitigation Plan to monitor and analyze effects on Reservation groundwater, CBNG resources, surface water, air quality and subsistence and cultural sites and values.	The monitoring programs sponsored by BLM are open to contracting by qualified Tribal members or companies.	The monitoring programs sponsored by BLM are open to contracting by qualified Tribal members or companies.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
C. Reservation Surface Water		
1. *Reinjection or Treatment.* All produced water from development of federal CBNG resources upstream of the Reservation in both Montana and Wyoming will either be reinjected (as provided for in DEIS Alternative B) or treated prior to discharge to meet the Northern Cheyenne Tribe's surface water quality standards (as provided in DEIS Alternative D). A special emphasis is placed on the Sodium Adsorption Ratio (SAR) and Electrical Conductivity (EC) parameters, especially during the irrigation season. Surface water flow and quality will be monitored to ensure that illegal discharges are not occurring. BLM or other federal agencies will provide the Tribe with funding to cover the costs of surface water monitoring on the Reservation.	Management of all federal produced water would be required to comply with Onshore Oil and Gas Order #7. Operators would be required to submit and receive approval of produced water management plans as part of their drilling and production plans. The water management plans would have to specify water treatment, disposal, and monitoring methods that would be followed in order to meet the state and EPA or Tribal water quality standards at the point of compliance. BLM would not approve any produced water permit applications until any necessary State, EPA, or Tribal permits required for water management actions were obtained.	Management of all federal produced water would be required to comply with Onshore Oil and Gas Order #7. Operators would be required to submit and receive approval of produced water management plans as part of their drilling and production plans. The water management plans would have to specify the methods that would be followed in order to comply with the Clean Water Act. BLM would not approve the discharge of CBNG waters to surface waters until any necessary State, EPA, or Tribal permits were obtained. The BLM would also require that untreated CBNG discharges would be cumulatively limited to 10% of the 7Q10 flow unless monitoring was occurring upstream and downstream from the outfall. If monitoring were in place the water quality thresholds identified in the monitoring appendix would be used.
2. *Effluent Guidelines and Standards of Performance.* To address discharges of CBNG production water from state-authorized development in Montana and Wyoming, EPA will promulgate effluent limitation guidelines under Section 304(b) of the Clean Water Act and/or national standards of performance for CBNG production wells under Section 306 of the Act. These standards and guidelines will require reinjection or treatment of produced water from new production wells. In addition, BLM and EPA, in conjunction with the Tribe, will encourage the states of Montana and Wyoming to negotiate a permanent agreement that includes the Tribe as a contracting party and that requires the State of Wyoming to prevent degradation of the Tongue River from Wyoming-authorized discharges.	The EPA and the state would need to determine the utility of promulgating effluent limits. The BLM would require operators to adhere to final regulations promulgated by the proper entity. The EPA and the states of Wyoming and Montana would need to determine the utility of an agreement on degradation of the Tongue River.	The EPA and the state would need to determine the utility of promulgating effluent limits. The BLM would require operators to adhere to final regulations promulgated by the proper entity. The EPA and the states of Wyoming and Montana would need to determine the utility of an agreement on degradation of the Tongue River.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
D. Reservation Air Quality		
1. *Increment Analysis and Prevention of Significant Deterioration.* The FEIS will include a regulatory "PSD Increment Consumption Analysis" for all relevant parameters and analyze the impact of such consumption on the potential for future economic development on the Reservation. It is not acceptable to the Tribe that this analysis be done in a piecemeal fashion as CBNG wells and compressor stations are permitted. On the basis of this increment consumption analysis, BLM's record of decision must provide for a development plan that is not likely to result in significant consumption of the Reservation's PSD Class I increment for any relevant parameter.	The BLM requires permitted actions on public lands (including oil and gas development) to comply with all applicable local, state, tribal, and federal air quality laws, regulations, standards, and implementation plans. BLM does not have the responsibility or authority to conduct a regulatory PSD Increment Consumption Analysis. However, the EIS predicts the potential for certain impacts and provides that a regulatory PSD Increment Consumption Analysis be conducted by the appropriate air quality regulatory agency (i.e., the Montana DEQ or the EPA) during permitting of specific CBNG development. This analysis would assess the likelihood of an exceedance and could be used to develop conditions to prevent a significant consumption of a Class I increment if an exceedance is determined likely. Operators would be required to provide the information necessary for BLM to conduct an analysis of air quality impacts for all relevant parameters when submitting their exploration APDs or field development project plans. BLM would use the information to determine the individual and cumulative impact on the Reservation's air quality; disclose the analysis results in the appropriate NEPA document; and consult with the Tribe when the analysis shows impacts from a specific drilling or development proposal.	The BLM requires permitted actions on public lands (including oil and gas development) to comply with all applicable local, state, tribal, and federal air quality laws, regulations, standards, and implementation plans. BLM does not have the responsibility or authority to conduct a regulatory PSD Increment Consumption Analysis. However, the EIS predicts the potential for certain impacts and provides that a regulatory PSD Increment Consumption Analysis be conducted by the appropriate air quality regulatory agency (i.e., the Montana DEQ or the EPA) during permitting of specific CBNG development. This analysis would assess the likelihood of an exceedance and could be used to develop conditions to prevent a significant consumption of a Class I increment if an exceedance is determined likely. Operators would be required to provide the information necessary for BLM to conduct an analysis of air quality impacts for all relevant parameters when submitting their exploration APDs or field development project plans. BLM would use the information to determine the individual and cumulative impact on the Reservation's air quality; disclose the analysis results in the appropriate NEPA document; and consult with the Tribe when the analysis shows impacts from a specific drilling or development proposal. For proposed federal CBNG development within 5 miles of the Northern Cheyenne and Crow Indian Reservations, the BLM, in consultation with the tribes, would require site-specific air analyses. The operator's analyses must demonstrate that the overall POD would be protective of Indian Trust, and air quality. If the analysis indicated that unacceptable levels of impairment to these resources would occur and could not be mitigated in consultation with the tribes, the BLM would not approve the APDs.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
2. *Mitigation.* The BLM should implement all measures to minimize air quality degradation suggested in Alternative B of the PFEIS. These include: appropriately surfacing roads and well locations to reduce fugitive dust generated by traffic; applying dust suppressors; enforcing speed limits on all project roads; minimizing construction of roads; air quality; requiring use of natural gas-fired and electric compressors; and optimizing the number of wells connected to one compressor.	Approval of exploration APDs and field development plans would include an analysis of the individual and cumulative impacts to air quality and be conditioned to prevent violations of applicable air quality laws, regulations, and standards. Mitigating measures may include surfacing roads and well locations; applying dust suppressants; requiring operators to develop and enforce speed limits on project roads; minimizing construction of roads; requiring use of natural gas-fired and electric compressors; and optimizing the number of wells connected to one compressor.	Approval of exploration APDs and field development plans would include an analysis of the individual and cumulative impacts to air quality and be conditioned to prevent violations of applicable air quality laws, regulations, and standards. To minimize potential air impacts from CBNG operations, the number of wells connected to each compressor would be maximized, and natural-gas-fired or electrical compressors or generators would be required. To reduce dust, operators of federal leases would have to post and enforce speed limits for their employees and contractors. Operators could work with local government to use dust suppression techniques on roads. Transportation corridors would be required: proposed roads, flowline routes, and utility line routes would be located to follow existing routes, or areas of previous surface disturbance, where possible. There would be minimal road construction. Prior to approving a road, the operator, landowner, the BLM, adjacent landowners, and adjacent gas leaseholders would coordinate long-term planning for roads in the area. Discussions with affected parties would take place to help meet the transportation corridor requirement.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
3. *Monitoring.* The BLM and other federal agencies will assist the Tribe in carefully monitoring impacts to the Reservation's air quality, including consumption of the Class I increment. Air quality monitoring should be conducted on the southern and eastern boundaries of the Reservation by continuous real time monitoring systems to ensure that Class I standards are not exceeded and that substantial consumption of Class I increment is not being consumed. Areawide monitoring will also occur within the 14-mile buffer zone. The location and frequency of air-quality monitoring will be determined based on the level of production in particular areas and climatic conditions.	Operators would conduct air quality monitoring, if required, as part of their individual air quality permits issued by the applicable air quality regulatory agency. This could require monitoring of air quality on the Reservation where there is a potential for impacts. Other federal agencies, primarily EPA, should be contacted to request assistance with general monitoring of Reservation air quality.	Operators would conduct air quality monitoring, if required, as part of their individual air quality permits issued by the applicable air quality regulatory agency. This could require monitoring of air quality on the Reservation where there is a potential for impacts. Other federal agencies, primarily EPA, should be contacted to request assistance with general monitoring of Reservation air quality.
4. *Modeling.* BLM should regularly update the air quality model developed as part of the NEPA process as new data is collected within the basin. If the updated model forecasts unanticipated impacts on Reservation air quality, BLM will take corrective action to limit further CBNG development in the vicinity of the Reservation.	Operators must provide information necessary for BLM to conduct an analysis of potential air quality impacts for all relevant parameters when submitting their exploration APDs and field development plans. BLM would periodically review these air quality modeling analyses in consultation with the Tribe.	Operators must provide information necessary for BLM to conduct an analysis of potential air quality impacts for all relevant parameters when submitting their exploration APDs and field development plans. BLM would periodically review these air quality modeling analyses in consultation with the Tribe.
5. *Remedies.* If monitoring and modeling finds that off-Reservation CBNG development is causing or threatening to cause significant consumption (to be precisely defined for each relevant air quality parameter in consultation with the Tribe) of the Reservation's Class I increment for any relevant parameter, BLM will take measures to restrict the timing or location of CBNG development in the vicinity of the Reservation so that consumption of the air quality increment will be reduced to less than significant levels.	Operators in the vicinity of the Reservation may be required to restrict the timing or location of CBNG development if monitoring or modeling by the air quality regulatory authority finds their CBNG development is causing or threatening to cause non-compliance with applicable local, state, tribal, and federal air quality laws, regulations, standards, and implementation plans.	Operators within 5 miles of the Northern Cheyenne and Crow Reservation boundaries may be required to restrict the timing or location of CBNG development if monitoring or modeling by the air quality regulatory authority finds their CBNG development is causing or threatening to cause non-compliance with applicable local, state, tribal, and federal air quality laws, regulations, standards, and implementation plans.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
E. Reservation Wildlife Resources		
1. Prior to further CBNG development in the Powder River RMP area, BLM will fund a wildlife study by a contractor chosen in consultation with the Tribe that: (a) fully assesses the likely impact of off-Reservation CBNG development on the wildlife resources of the Northern Cheyenne Reservation; and (b) evaluates measures, such as establishing buffer zones and wildlife refuges to protect critical habitat, that will prevent and avoid significant impacts to Reservation wildlife resources.	The mitigating measures for wildlife are part of the standard APD review and approval process. In addition, impacts on wildlife, including those species on and adjacent to the Reservation, would be monitored and addressed per the *Wildlife Monitoring and Protection Plan* (see Wildlife Appendix). The Tribe would be invited to participate in the "steering group" that would evaluate information gathered during the inventory and monitoring phases of the *Wildlife Monitoring and Protection Plan.*	The mitigating measures for wildlife are part of the standard APD review and approval process. In addition, impacts on wildlife, including those species on and adjacent to the Reservation, would be monitored and addressed per the *Wildlife Monitoring and Protection Plan* (see Wildlife Appendix). The Tribe is active in a steering group via the Interagency Working Group to evaluate information gathered during the inventory and monitoring phases of the *Wildlife Monitoring and Protection Plan.*
2. Based on the findings of the wildlife study and in consultation with the Tribe, BLM will implement, in the form of additional RMP amendments, leasing stipulations, or operating plan conditions, all measures found necessary to fully protect Reservation wildlife resources from the impacts of off-Reservation CBNG development.	The results of the *Wildlife Monitoring and Protection Plan* would be used to adjust conditions of approval at the APD stage. This includes measures needed to protect Reservation wildlife from the impacts of CBNG development.	The results of the *Wildlife Monitoring and Protection Plan* would be used to adjust conditions of approval at the APD stage. This includes measures needed to protect Reservation wildlife from the impacts of CBNG development.
F. Noxious Weeds		
1. Operating plans will provide that vehicles and equipment associated with CBNG exploration or development must be thoroughly washed to remove seeds before passing through the Reservation. This requirement should include all personnel including operators, construction workers, contractors, and researchers.	Operators are responsible for noxious weed control on all drill pads, roads, pipelines, and other production related sites for the life of the facility. Operators would be required to include plans to prevent the spread of noxious weeds as part of their development plans. The noxious weed prevention plans must include measures to prevent the spread of weed seeds from any vehicles and equipment prior to mobilizing it to the project area (this would include contractors and researchers).	Operators are responsible for noxious weed control on all drill pads, roads, pipelines, and other production related sites for the life of the facility. Operators would be required to include plans to prevent the spread of noxious weeds as part of their development plans. The noxious weed prevention plans must include measures to prevent the spread of weed seeds from any vehicles and equipment prior to mobilizing it to the project area (this would include contractors and researchers).
2. Operating plans will provide for mandatory training of all employees and contractors in noxious weed awareness and prevention.	The Operator would be responsible for the training of employees in noxious weed awareness and prevention. Training would be one required component of the operator's noxious weed prevention plans.	The Operator would be responsible for the training of employees in noxious weed awareness and prevention. Training would be one required component of the operator's noxious weed prevention plans.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
3. Operating plans and permits to drill will require use of common corridors and minimization of roads within the development area as provided in Alternative B to the DEIS to reduce the spread of noxious weeds in the region. All development roads will be restored to the original contours and re-vegetated with the appropriate native and/or hearty vegetation. At least two years of monitoring at the abandoned production field is required to ensure that noxious weeds have not invaded the area.	Operator reclamation plans for access roads and drill sites would include recontouring to near original contour and seeding the area with a certified weed-free seed mix. Upon abandonment, revegetated areas would require at least two growing seasons before bond release in order to ensure that a self-sustaining stand of weed free vegetation had been established.	Operator reclamation plans for access roads and drill sites would include recontouring to near original contour and seeding the area with a certified weed-free seed mix. Upon abandonment, revegetated areas would require at least two growing seasons before bond release in order to ensure that a self-sustaining stand of weed free vegetation had been established.
Part II, Socioeconomic: **A. Specific Socioeconomic Mitigation Measures**		
The following *Employment Preference* [1a and 1b] will apply to all federal and state CBNG leases that include lands within 25 miles of the Reservation boundary.	The BLM has a responsibility to examine the socioeconomic impacts on the Northern Cheyenne Tribe from off reservation CBNG development (see Chapter 4). The BLM does not have the authority to require operators outside the Reservation boundary to preferentially hire Native Americans.	The BLM has a responsibility to examine the socioeconomic impacts on the Northern Cheyenne Tribe from off reservation CBNG development (see Chapter 4). The BLM does not have the authority to require operators outside the Reservation boundary to preferentially hire Native Americans.
la. *Employment Preference.* Indians who live on or near the Northern Cheyenne Reservation and are qualified and available ("Qualified Indians") will be given preference in recruitment, training, hiring, promotion, and reductions in work force, in all categories of employment in operations on or near the lease.	The proposed employment preferences can only be required for tribal lease operations on the Reservation. The BLM does not have the authority to require operators outside the Reservation boundary to preferentially hire Native Americans.	The proposed employment preferences can only be required for tribal lease operations on the Reservation. The BLM does not have the authority to require operators outside the Reservation boundary to preferentially hire Native Americans.

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1b. *Employment Preference.* The employment preference will be implemented under the terms of a separate written agreement between the Tribe and the lessee. Negotiation of this agreement will commence as promptly as possible and be conducted with diligence and good faith. To expedite the negotiation, the United States, State of Montana, and Tribe will diligently and in good faith promptly concur on a Model Employment Agreement as a guide. Without limitation, the Model Employment Agreement and each Tribe-lessee agreement will include the terms and conditions set forth in i through iv below. Each Tribe-lessee agreement must be approved by the United States as to leases of federally-owned CBNG, and the state as to leases of state or privately-owned CBNG: i. Special programs for the recruitment of qualified Indians. ii. Special programs for the training of qualified Indians, including on-the-job training and training for advancement into supervisory positions. iii. Special workshops for other project work force to develop an awareness of Indian culture and concerns and an understanding of the need for and requirements of the employment preference. iv. Preservation of the lessee's authority to establish reasonable, even-handed, and job-validated training programs, employment criteria, and work rules for all employees, including qualified Indians. v. Notification to all involved labor unions of the existence of the employment preference and of the lessee's duty and intent to abide by its terms. vi. A requirement that project contractors and subcontractors assume and comply with all terms and conditions of the employment preference in connection with their own project employment practices.	The proposed employment preferences agreement can only be required for tribal lease operations on the Reservation. The BLM does not have the authority to require operators outside the Reservation boundary to enter into the employee preference agreement.	The proposed employment preferences agreement can only be required for tribal lease operations on the Reservation. The BLM does not have the authority to require operators outside the Reservation boundary to enter into the employee preference agreement.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
2. The following *Contracting Preference* (2a and 2b) will apply to all federal and state CBNG leases that include lands within 25 miles of the Reservation boundary.	The BLM has a responsibility to examine the socioeconomic impacts on the Northern Cheyenne Tribe from off-Reservation CBNG development (see Chapter 4). The BLM does not have the authority to require operators outside the Reservation boundary to preferentially contract with Northern Cheyenne Contractors.	The BLM has a responsibility to examine the socioeconomic impacts on the Northern Cheyenne Tribe from off-Reservation CBNG development (see Chapter 4). The BLM does not have the authority to require operators outside the Reservation boundary to preferentially contract with Northern Cheyenne Contractors.
2a. Businesses that are majority-owned and controlled by the Northern Cheyenne Tribe and/or its members ("Northern Cheyenne Contractors") will be given preference in the awarding of all contracts and subcontracts for the conduct of operations on or near the lease, and for the procurement of material and equipment for such operations.	The proposed contracting preferences can only be required for tribal lease operations on the Reservation. The BLM does not have the authority to require operators outside the Reservation boundary to preferentially contract with Northern Cheyenne Contractors.	The proposed contracting preferences can only be required for tribal lease operations on the Reservation. The BLM does not have the authority to require operators outside the Reservation boundary to preferentially contract with Northern Cheyenne Contractors.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
2b. These preferences will be implemented under the terms of a separate written agreement between the Tribe and the lessee. Negotiation of this agreement will commence as promptly as possible and be conducted with diligence and good faith. To expedite the negotiation, the United States, State of Montana, and Tribe will diligently and in good faith promptly concur on a Model Contracting Agreement as a guide. Without limitation, the Model Contracting Agreement and each Tribe-lessee agreement will include the terms and conditions set forth in i through iii below. Each Tribe-lessee agreement must be approved by the United States as to leases of federally-owned CBNG, and the state as to leases of state or privately-owned CBNG: i. A fair and objective procedure under which a business entity applying for the status of Northern Cheyenne Contractor must be certified in the following two respects: (1) as an entity actually majority-owned and controlled by the Tribe and/or a Tribal member; and (2) as an entity capable of competently providing particular contract services or supplying particular material or equipment. ii. Advance notice to certified Northern Cheyenne Contractors of service or procurement contracts to be awarded for which they are qualified. iii. A requirement that project contractors and subcontractors assume and comply with all terms and conditions of these preferences in connection with their own project contracting and procurement practices.	The proposed contracting preferences agreement can only be required for tribal leases issued for operations on the Reservation. The BLM does not have the authority to require operators outside the Reservation boundary to enter into the contracting preference agreement.	The proposed contracting preferences agreement can only be required for tribal leases issued for operations on the Reservation. The BLM does not have the authority to require operators outside the Reservation boundary to enter into the contracting preference agreement.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
3. *Law and Order; Traffic.* The following (3a thru 3e) will apply to all federal and state CBNG leases that include lands within Rosebud, Powder River and Bighorn Counties.	The BLM has a responsibility to examine the socioeconomic impacts on the Northern Cheyenne Tribe from off-Reservation CBNG development (see Chapter 4). The BLM does not have the authority to require law and order adherence covenants from operators for off- Reservation CBNG development. Compliance with applicable traffic laws is necessary for all individuals and companies when operating on public roads within the Reservation.	The BLM has a responsibility to examine the socioeconomic impacts on the Northern Cheyenne Tribe from off-Reservation CBNG development (see Chapter 4). The BLM does not have the authority to require law and order adherence covenants from operators for off-Reservation CBNG development. Compliance with applicable traffic laws is necessary for all individuals and companies when operating on public roads within the Reservation.
3a. The lessee will obtain a covenant from each of its employees that while on the Reservation for any purpose, the employee will comply with all standards of conduct generally applicable to Tribal members.	The proposed covenant can only be required for tribal leases issued for operations on the Reservation. The BLM does not have the authority to require lessees outside the Reservation boundary to require their employees to sign the general conduct covenant.	The proposed covenant can only be required for tribal leases issued for operations on the Reservation. The BLM does not have the authority to require lessees outside the Reservation boundary to require their employees to sign the general conduct covenant.
3b. Each lessee will obtain a covenant from each of its truckers that while operating on the Reservation, the trucker will comply with all laws, ordinances and rules applicable to the use of motor vehicles by Tribal members.	The proposed covenant can only be required for tribal leases issued for operations on the Reservation. The BLM does not have the authority to require lessees outside the Reservation boundary to require their truckers to sign the traffic covenant.	The proposed covenant can only be required for tribal leases issued for operations on the Reservation. The BLM does not have the authority to require lessees outside the Reservation boundary to require their truckers to sign the traffic covenant.
3c. Each lessee will by contract require (i) each of its contractors and subcontractors to obtain like covenants from their employees and truckers, and (ii) each of its suppliers to obtain a like covenant from their truckers.	The proposed covenant can only be required for tribal leases issued for operations on the Reservation. The BLM does not have the authority to require lessees outside the Reservation boundary to require their contractors and subcontractors to sign a covenant.	The proposed covenant can only be required for tribal leases issued for operations on the Reservation. The BLM does not have the authority to require lessees outside the Reservation boundary to require their contractors and subcontractors to sign a covenant.
3d. The above described duties imposed on employees and truckers will be enforced by each lessee, and its contractors, subcontractors, and suppliers, by taking appropriate employee-related disciplinary action in the event such duties are violated.	The BLM does not have the authority to require lessees outside the Reservation boundary to discipline individual employees.	The BLM does not have the authority to require lessees outside the Reservation boundary to discipline individual employees.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
3e. These provisions will be implemented under the terms of a separate written agreement between the Tribe and each lessee. Negotiation of this agreement will commence as promptly as possible and be conducted with diligence and good faith. To expedite the negotiation, the United States, State of Montana, and Tribe will diligently and in good faith promptly concur on a Model Law and Order/Traffic Agreement as a guide. Without limitation, the Model Law and Order/Traffic Agreement and each Tribe-lessee agreement will include the term and conditions set forth in i through v below. Each Tribe-lessee agreement must be approved by the United States as to leases of federally-owned CBNG, and the state as to leases of state or privately-owned CBNG: i. Assumption in writing by each employee and trucker of the conditions set forth in a through d above. ii. Education of employees and truckers with respect to the standards of conduct they must observe while on the Reservation. iii. Appropriate employee-related disciplinary action for particular violations. iv. Resolution of disputes concerning the occurrence of violations. v. Notification to all involved labor unions of the existence of the written agreement and the lessee's duty and intent to abide by its terms.	The proposed agreement can only be required for tribal leases issued for operations on the Reservation. The BLM does not have the authority to require lessees outside the Reservation boundary to require their contractors and subcontractors to sign the written agreement.	The proposed agreement can only be required for tribal leases issued for operations on the Reservation. The BLM does not have the authority to require lessees outside the Reservation boundary to require their contractors and subcontractors to sign the written agreement.
4. *Impact Funding.* The Tribe proposes the following impact funding program described in 4a through 4e.	The BLM has a responsibility to examine the socioeconomic impacts on the Northern Cheyenne Tribe from off-reservation CBNG development (see Chapter 4). The BLM does not have the authority to require impact funding.	The BLM has a responsibility to examine the socioeconomic impacts on the Northern Cheyenne Tribe from off-reservation CBNG development (see Chapter 4). The BLM does not have the authority to require impact funding.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
4a. The Federal government returns 50% of all CBNG lease bonuses, rentals and royalties to the state ("Off-Reservation Federal Impact Funds"). By federal statute, these funds are to be used to mitigate socioeconomic impacts of CBNG development on local communities. In the region, these impacts can be expected to occur in Big Horn, Rosebud, and Powder River Counties (the "Three County Area"), both on and off the Reservation. No portion of the off-Reservation Federal Impact Funds will be made available to the Tribe.	Of the monies received from sales, bonuses, and royalties on federal public domain leases, 50% is returned to the state or its governmental subdivisions where the leases are located. The state legislature is the body that controls disposition of the monies received and determines the priority of fund distribution to those subdivisions economically impacted by development. BLM does not have the discretion or authority to redistribute federal royalties.	Of the monies received from sales, bonuses, and royalties on federal public domain leases, 50% is returned to the state or its governmental subdivisions where the leases are located. The state legislature is the body that controls disposition of the monies received and determines the priority of fund distribution to those subdivisions economically impacted by development. BLM does not have the discretion or authority to redistribute federal royalties.
4b. The Tribe will be provided with a degree of proportionate funding.	Of the monies received from sales, bonuses, and royalties on federal public domain leases, 50% is returned to the state or its governmental subdivisions where the leases are located. The state legislature is the body that controls disposition of the monies received and determines the priority of fund distribution to those subdivisions economically impacted by development. BLM does not have the discretion or authority to redistribute federal royalties.	Of the monies received from sales, bonuses, and royalties on federal public domain leases, 50% is returned to the state or its governmental subdivisions where the leases are located. The state legislature is the body that controls disposition of the monies received and determines the priority of fund distribution to those subdivisions economically impacted by development. BLM does not have the discretion or authority to redistribute federal royalties.
4c. The impact funding will be provided to the Tribe for the exclusive purpose of planning and providing public services and facilities on the Reservation.	Of the monies received from sales, bonuses, and royalties on federal public domain leases, 50% is returned to the state or its governmental subdivisions where the leases are located. The state legislature is the body that controls disposition of the monies received and determines the priority of fund distribution to those subdivisions economically impacted by development. BLM does not have the discretion or authority to redistribute federal royalties.	Of the monies received from sales, bonuses, and royalties on federal public domain leases, 50% is returned to the state or its governmental subdivisions where the leases are located. The state legislature is the body that controls disposition of the monies received and determines the priority of fund distribution to those subdivisions economically impacted by development. BLM does not have the discretion or authority to redistribute federal royalties.
4d. The funding will be calculated by taking the amount of off-Reservation Federal Impact Funds generated by all federal CBNG leases that lie in whole or in part in the Three County Area, dividing by the off-Reservation resident population of the Three County Area, and then multiplying by the resident population of the Reservation.	The BLM does not have the authority to redistribute the federal royalties.	The BLM does not have the authority to redistribute the federal royalties.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
4e. The funding will be provided to the Tribe at the same time that the off-Reservation Federal Impact Funds are provided to the state.	The BLM does not have the authority to redistribute the federal royalties.	The BLM does not have the authority to redistribute the federal royalties.
4f. There are several possible sources for the impact funding, including without limitation the following and combinations thereof: (1) entirely from the lessees, via lease stipulations, permit conditions or operating plans; (2) from the lessees, but at no cost to the lessees, through exercise of the Secretary's existing authority under 30 USC §209 to grant royalty reductions to lessees, accompanied by a commitment from the lessees to pay to the Tribe an amount equal to the royalty reductions; (3) from the 50% share of the federal lease bonuses, rents, and royalties retained by the United States. Presumably, this will require federal legislation.	The BLM does not have the authority to require impact funding. A royalty rate reduction cannot be legally granted to the lessees to offset payments by the lessees for impact funding. The BLM does not have the authority to redistribute the federal royalties.	The BLM does not have the authority to require impact funding. A royalty rate reduction cannot be legally granted to the lessees to offset payments by the lessees for impact funding. The BLM does not have the authority to redistribute the federal royalties.
Part III, Cultural: **A. Protection of Northern Cheyenne Homesteads**		
A buffer zone should be established around the Northern Cheyenne homestead sites in the Otter Creek and Hanging Woman drainages. Since current archaeological survey data is inadequate to identify all these sites, all sections where land records indicate Northern Cheyenne homesteading activity took place should be withheld from CBNG exploration and development. These sections are identified in Appendix G to the Tribe's Narrative Report.	Operators would be required to include review of Northern Cheyenne homestead records and evaluation for homesteads in the cultural resource surveys where land records indicate Northern Cheyenne homesteading activity. Specific measures to mitigate impacts to these homesteads would be developed at the APD approval phase. A review of land and mineral ownership maps indicate that one homestead location listed in Appendix C of the Ethnographic Report may be located on an area open to fluid mineral leasing. The location is on split estate with private surface and federal minerals. Prior to any land disturbing activity permitted by the BLM in this location, and with landowner permission, BLM would work with the Northern Cheyenne Tribe and the operator to develop the requirements for inventorying, recording, and evaluating the homestead site. BLM would provide technical assistance to the Tribe in inventorying, recording, and evaluating the homestead site.	Operators would be required to include review of Northern Cheyenne homestead records and evaluation for homesteads in the cultural resource surveys where land records indicate Northern Cheyenne homesteading activity. Specific measures to mitigate impacts to these homesteads would be developed at the APD approval phase. A review of land and mineral ownership maps indicate that one homestead location listed in Appendix C of the Ethnographic Report may be located on an area open to fluid mineral leasing. The location is on split estate with private surface and federal minerals. Prior to any land disturbing activity permitted by the BLM in this location, and with landowner permission, BLM would work with the Northern Cheyenne Tribe and the operator to develop the requirements for inventorying, recording, and evaluating the homestead site. BLM would provide technical assistance to the Tribe in inventorying, recording, and evaluating the homestead site.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
B. Protection of Significant Hunting, Fishing and Plant Gathering Areas in Tongue River Valley		
The 14-mile buffer zone proposed by the Tribe to protect Reservation groundwater resources should be adequate to protect culturally significant plant gathering areas within the Tongue River valley. However, if CBNG development is authorized within the buffer zone, the following protocols should be followed:	Development is presumed to occur at some future time within the 14-mile area.	Development is presumed to occur at some future time within the 14-mile area.
1. No development will be permitted up to five miles cast of the Tongue River between Ashland and Birney without mitigation measures designed to avoid disturbance of important hunting, fishing, and plant gathering sites.	In the area east of the Tongue River between Ashland and Birney, with important hunting, fishing, and plant gathering sites, operators would be required to inventory BLM lands for traditional plant gathering sites around the proposed drilling locations. APD approvals may include avoidance or timing restrictions to prevent impacts to identified important hunting, fishing and plant gathering sites.	In the area east of the Tongue River between Ashland and Birney, with important hunting, fishing, and plant gathering sites, operators would be required to inventory BLM lands for traditional plant gathering sites around the proposed drilling locations. APD approvals may include avoidance or timing restrictions to prevent impacts to identified important hunting, fishing and plant gathering sites.
2. BLM operating plans will require that prior to development in areas within five miles (east) of the Tongue River between Ashland and Birney, the project proponent and BLM will consult with the Northern Cheyenne Cultural Commission to determine the location of any important hunting, fishing, and plant gathering sites. The BLM, in consultation with the Tribes Cultural Commission, will design measures to avoid disturbance of these important areas.	In the area east of the Tongue River between Ashland and Birney, operators would be required to consult with the Northern Cheyenne Cultural Commission to determine the location of any important hunting, fishing, and plant gathering sites. APD approvals would include measures to avoid impacts to these resources using standard terms and conditions.	In the area east of the Tongue River between Ashland and Birney, operators would be required to consult with the Northern Cheyenne Cultural Commission to determine the location of any important hunting, fishing, and plant gathering sites. APD approvals would include measures to avoid impacts to these resources using standard terms and conditions.
3. No permits to drill will be issued within three miles of Poker Jim Butte to protect an important medicinal and ceremonial plant gathering area in that location.	Operators would be required to conduct a plant inventory on BLM lands proposed for disturbance near Poker Jim Butte. Impacts on medicinal and ceremonial plant gathering areas could then be mitigated using standard terms and conditions. **Note**: The butte is within the Custer National Forest.	Operators would be required to conduct a plant inventory on BLM lands proposed for disturbance near Poker Jim Butte. Impacts on medicinal and ceremonial plant gathering areas could then be mitigated using standard terms and conditions. **Note**: The butte is within the Custer National Forest (Forest Service administration).

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
4. BLM will monitor the effects to the Northern Cheyenne subsistence economy from CBNG development by funding annual updates to the Tribe's subsistence survey (Northern Cheyenne Tribe 2002). A Wildlife Technical Working Group, whose membership will include Northern Cheyenne and agency wildlife specialists, will routinely review the subsistence data of each year. On the basis of this data, they should recommend changes in leasing stipulations to curtail any noted deleterious effects to Northern Cheyenne subsistence hunting, fishing, and plant gathering. This group will also review all reclamation plans to ensure that habitat diversity around the Reservation is maintained and plants with traditional cultural uses are included in the revegetation seed mixes.	BLM would welcome the participation of the Northern Cheyenne in the "steering group" that would evaluate information gathered during the inventory mid monitoring phases of the Wildlife Monitoring and Protection Plan.	BLM and the Tribe are active in the steering group via the Interagency Working Group to evaluate information gathered during the inventory mid monitoring phases of the Wildlife Monitoring and Protection Plan.
C. Protection of Culturally Important Springs		
1. The BLM will inventory springs off the Reservation within the 14-mile buffer zone. This will include locating springs by GPS, determining the source of the water, measuring the flow, monitoring water quality parameters, and documenting vegetation growth and condition with photos and video. A comprehensive spring inventory should be conducted at least twice per year.	Operators would be required to inventory all springs supplied by the coal seam producing CBNG within the anticipated drawdown radius of their proposed operation.	Operators would be required to inventory all springs supplied by the coal seam producing CBNG within the anticipated drawdown radius of their proposed operation. Additionally the IWG has developed a Regional Groundwater Monitoring Plan, which includes springs (see monitoring appendix).
2. If development is allowed within the 14-mile buffer, no permits to drill will be issued within three miles of an inventoried spring prior to consultation with the Northern Cheyenne Cultural Commission regarding the cultural significance of the spring to the Tribe.	The Northern Cheyenne Cultural Commission would be consulted about the appropriate mitigation if culturally significant springs were located within the anticipated drawdown radius of the operator's proposed development.	The Northern Cheyenne Cultural Commission would be consulted about the appropriate mitigation if culturally significant springs were located within the anticipated drawdown radius of the operator's proposed development.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
3. Springs that are identified by the Cultural Commission as having special significance to the Northern Cheyenne will be protected by a buffer zone adequate to protect medicinal and ceremonial plants as well as the spiritual beings that inhabit the springs and maintain the current conditions that facilitate traditional cultural use of the springs for prayer, offerings, and ceremonies. The size and shape of the buffer zone will be determined by BLM, in consultation with the Tribe based on the best available hydrological data.	Operators may be required to avoid impacting culturally significant springs as part of the mitigation plan developed under Section 106 of the National Historic Preservation Act.	Operators may be required to avoid impacting culturally significant springs as part of the mitigation plan developed under Section 106 of the National Historic Preservation Act.
4. Where drilling is allowed within three miles of a culturally important spring, BLM will monitor the drawdown of aquifers related to the spring on a systematically scheduled basis and provide timely reports of the monitoring data to the Tribe. The Northern Cheyenne Tribe will be full participants in a Technical Working Group that oversees the monitoring. (It could be most cost efficient to have the Northern Cheyenne collect this data and distribute it to all interested parties).	Operators could be required to monitor the condition of culturally significant springs where there is the potential for production activities to impact the springs. This requirement would be triggered by the results of the site specific hydrologic evaluation associated with the APD approval.	Operators could be required to monitor the condition of culturally significant springs where there is the potential for production activities to impact the springs. This requirement would be triggered by the results of the site specific hydrologic evaluation associated with the APD approval.
5. In keeping with the best adaptive management practices, the BLM will halt pumping CBNG production around culturally important springs if monitoring data indicates that dewatering of the spring is occurring or imminent.	Operators must modify federal CBNG production if monitoring data shows production is affecting culturally important springs. The operator must implement mitigating measures that would maintain the spring flow prior to resuming full production.	Operators must modify federal CBNG production if monitoring data shows production is affecting culturally important springs. The operator must implement mitigating measures that would maintain the spring flow prior to resuming full production.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
D. Protection of Grave Sites		
To protect grave sites, BLM should not issue permits to drill within a mile of all Tribal burials, graves, or cemeteries (regardless of temporal or Tribal affiliation).	Operators would be required to have a discovery plan as part of their plan of development. The discovery plan would include suspension of operations and notification requirements for state, private, and federal lands in the event human remains are discovered during project construction. Should human remains be discovered during construction, BLM would consult with the Northern Cheyenne on the appropriate distance between the project and gravesite.	Operators would be required to have a discovery plan as part of their plan of development. The discovery plan would include suspension of operations and notification requirements for state, private, and federal lands in the event human remains are discovered during project construction. Should human remains be discovered during construction, BLM would consult with the Northern Cheyenne on the appropriate distance between the project and gravesite.
E. Prevention and Mitigation of Impacts to Northern Cheyenne Cultural Resources		
1. BLM will support (by providing funding, training, and in kind services) the creation of a Tribal Historical Preservation Office (THPO). The THPO will focus on Tribal culture, history, geography, and related research, and on building a Northern Cheyenne Archive. The THPO will be a clearinghouse for cultural resource information and the development of a public outreach program and education program for all grade levels in local schools.	BLM supports the creation of a Northern Cheyenne Tribal Historic Preservation Office. This would need to be done through the National Park Service. BLM cannot commit to funding the office. BLM would share data with the THPO from cultural resource investigations associated with CBNG development. This information could then be used for tribal educational and outreach efforts.	BLM supports and coordinates with the Northern Cheyenne Tribal Historic Preservation Office. BLM cannot commit to funding the office. BLM shares data with the THPO from cultural resource investigations associated with CBNG development. The information can be used for tribal educational and outreach efforts.
2. Mechanisms will be established to enable the Tribe to monitor all site-specific cultural resource work done for CBNG development to ensure that all Tribally affiliated properties are recorded and evaluated in a culturally appropriate fashion. This should include, but not necessarily be limited to, the respectful treatment of human remains, items of cultural patrimony, and materials relating to ongoing traditional cultural uses of sites (e.g., offering cloths, etc.).	When tribally affiliated properties would be affected by CBNG developments, BLM may require a tribal monitor. Under most normal circumstances, cultural resource work does not require a monitor.	When tribally affiliated properties would be affected by CBNG developments, BLM may require a tribal monitor. Under most normal circumstances, cultural resource work does not require a monitor.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
3. All Tribally affiliated properties will be evaluated under the National Historic Preservation Act in accordance with NPS Bulletins 15, 16 and 38. Bulletin 38 evaluations must include face-to-face contacts with Northern Cheyenne cultural resource specialists, culture historians and/or culture committee members. Evaluations will include specific discussions of Cheyenne history and culture as well as scientific values.	All cultural properties recorded as a result of CBNG related activities would be evaluated for listing on the National Register of Historic Places. BLM would consult with the Northern Cheyenne Tribe when properties were evaluated as Traditional Cultural Properties.	All cultural properties recorded as a result of CBNG related activities would be evaluated for listing on the National Register of Historic Places. BLM would consult with the Northern Cheyenne Tribe when properties were evaluated as Traditional Cultural Properties.
4. Cultural resource contractors hired by the BLM or project proponents and BLM archaeologists will demonstrate good faith consultation with the Tribe and make every attempt to include Cheyenne cultural resource specialists in all aspects of their work.	This is a current requirement by BLM for both themselves and BLM cultural resource permit holders.	This is a current requirement by BLM for both themselves and BLM cultural resource permit holders.
5. Cultural resource technical reports approved by the BLM will follow current best practice standards and be accompanied by public narratives suitable for use in Northern Cheyenne schools.	BLM's report standards are found in the BLM's 8100 Manual and Handbooks and are augmented by current professional standards. When reports contain data that would be of interest to the Tribe or the public, BLM may require the operator's consulting archaeologist to prepare a public narrative of their work.	BLM's report standards are found in the BLM's 8100 Manual and Handbooks and are augmented by current professional standards. When reports contain data that would be of interest to the Tribe or the public, BLM may require the operator's consulting archaeologist to prepare a public narrative of their work.
6. Treatment plans for historic properties (eligible sites) will always give the highest priority to avoidance when the property is eligible as a Traditional Cultural Property (under Bulletin 38). If a site is eligible, only for its scientific value, mitigation through data recovery may be considered if the site can not be avoided. Training opportunities for the Cheyenne in archaeological excavation techniques and/or public awareness programs for Northern Cheyenne students will accompany any excavation of tribally affiliated sites.	Avoidance is BLM's standard policy for not adversely affecting historic properties. BLM would consult with the Northern Cheyenne Tribe for sites that are found eligible as a Traditional Cultural Property.	Avoidance is BLM's standard policy for not adversely affecting historic properties. Operators would have to consult with affected tribes when proposing actions near American Indian traditional cultural properties, such as the Rosebud Battlefield and the Wolf Mountains Battlefield. Consultation might result in mitigation of impacts to traditional cultural properties.

Northern Cheyenne Tribe—Proposed Mitigation	BLM Mitigation Measures Under Alternative E	BLM Mitigation Measures Under Alternative H
7. All well locations and ancillary facilities (roads, pipelines, etc.) that cause ground disturbance will be intensively inventoried for cultural resources. Cultural resources include archaeological sites, plant collecting areas, paint sources, baculite sources, and earthlodges (sacred hills), and bird habitats, e.g., nesting area of birds who participate in Northern Cheyenne ceremonial life. This will require Northern Cheyenne participation in the survey effort to identify paint, plant, and earthlodge sites.	Inventory of well locations and ancillary facilities is a current requirement prior to surface disturbance. Inventory strategies would be discussed as part of the cultural resources section of plans of development.	Inventory of well locations and ancillary facilities is a current requirement prior to surface disturbance. Inventory strategies would be discussed as part of the cultural resources section of plans of development.
8. Since CBNG development, if permitted, could cause a cumulatively significant amount of ground disturbance, the various site-specific reports should be compiled and the data synthesized into an over-riding and undatable technical document at the end of each field season. In keeping with modern adaptive management strategies, this synthesis will be reviewed by a Cultural Resources Technical Working Group (CRTWG), which should include Northern Cheyenne culture historians/elders and/or Tribal Historical Preservation officers designated by the Tribe along with agency cultural resource specialists.	BLM would provide the Tribe a copy of BLM's annual cultural resources report, which would summarize CBNG related cultural resource activities. BLM would participate in the Cultural Resources Working Group.	BLM currently provides the Tribe a copy of BLM's annual cultural resources report, which summarizes CBNG related cultural resource activities. BLM would participate in the Cultural Resources Working Group.
9. A $300 filing fee will be included in the cultural resource contracts. This filing fee will be allocated to the Northern Cheyenne Tribe for the development and support of the THPO.	The authorities under which BLM currently issues cultural resource use permits and fieldwork authorizations do not provide for the collection of fees.	The authorities under which BLM currently issues cultural resource use permits and fieldwork authorizations do not provide for the collection of fees.

[1] "Operator" refers to "oil and gas" operator.
[2] Field development refers to operator requests for approval of additional wells other than in accordance with current spacing (1 well per 640 acres/coal seam).

Northern Cheyenne Proposed Mitigation	BLM Mitigation/Monitoring for Alternative [illegible]	[illegible]
[illegible] sites, plant gathering [illegible] sources, medicine sources, and [illegible] lodges (sacred hills), and bird habitats, e.g., nesting area of birds who participate in Northern Cheyenne ceremonial life. This will require Northern Cheyenne participation in the survey effort to [illegible]	[illegible] would be evaluated as part of the [illegible]	[illegible]
9. Since CBNG [illegible] development could have a cumulatively significant impact of ground disturbance, the various site-specific reports should be compiled and the data synthesized [illegible]	BLM would provide the Tribe a copy of the BLM's annual cultural resources report, which would summarize CBNG-related cultural resource activities. BLM would participate in the Cultural Resources Working Group.	[illegible]
[illegible] development and impact of the THPO.	The authorities under which BLM currently manages cultural resources and [illegible] actions do not provide for [illegible] of sites.	[illegible]

[1] "Operator" refers to "oil and gas" operator.
[2] [illegible]

SOCIOECONOMICS APPENDIX

SOCIOECONOMICS APPENDIX

Attitudes, Beliefs, Lifestyles, and Values

Population Groups

General information about population groups was developed from a number of sources, including the documents cited in the text. While the generalized characterizations are not likely to apply to all individuals, the intention is to provide an idea of the range of the attitudes and lifestyles of the population subgroups present in the study area.

The study area population is largely rural, with strong ties to the land and to the many small towns. Ranch and farm families are one of the major groups of people living in the study area. They tend to favor traditional land uses and the preservation of intergenerational family operations. They may feel reluctance toward short-term developments that will alter their lifestyle. The study area population also includes long-time small town residents. While these people generally wish to maintain their way of life, at the same time, some may seek to find a compromise between their current situation and gradual development.

Another portion of the population in the study area is Native Americans, many of whom are residents of the three Indian reservations within the study area. These groups generally desire to preserve many elements of their heritage and do not wish to become homogenized into and by the non-Indian culture. At the same time, some tribal members or subgroups are pursuing the development of energy resources for the long-term social and economic betterment of tribal members.

A small but growing population is made up of professionals, craftspeople, retirees, and others who have moved to small towns to enjoy the slower pace of life and various amenities. While the forested areas of western Montana tend to attract more of this group than eastern Montana, these people are present in the study area as well. They may participate in opposition to development proposals that appear to jeopardize the quality of their new lifestyles.

Areas where energy resources are developed often see the influx of people from other areas. Many of these people regard their employment as temporary, expect to move on to other areas, and do not play an integral part in community affairs. Long-term local residents often resent these "outsiders" while at the same time realizing some economic benefits from the business and service demands of these newcomers.

In summary, residents generally value the rural character of their lifestyle. Specific aspects of this lifestyle might include appreciation of wide-open spaces, natural landscape, fresh air and solitude. The lifestyle of rural communities often offers the desirable qualities of neighbors knowing each other, lack of urban problems, relaxed pace, personal freedom, and being a good place to raise children. Longtime residents often want to see continued control of the land at the local level without interference from outside agencies or groups.

Public Comments from EIS Scoping Process (2001)

The public comments received during the Statewide Document scoping process convey important information about general attitudes toward coal bed natural gas (CBNG) and other energy or mineral development. The vast majority of public comments received during scoping relayed concerns about potential impacts on water quality and quantity. Specifically, commentators were concerned with the discharge of water of poor quality (e.g., saline) and the drawdown of groundwater aquifers.

Public comments are often shaped by an individual's lifestyle and livelihood. For example, ranching and irrigated agriculture are both dependent on the supply of water. Of the comments received by individuals engaged in farming and ranching, a great many related to concerns about potential degradation of water quality and quantity, in addition to general environmental impacts. The comments reflect a tension between the desire for new development to support the often stagnant rural economies and the concern that such development could harm the environment and the lifestyle qualities for which Montana is known, including natural beauty, wide-open spaces, and solitude.

In general the comments reflect a difference in attitudes toward CBNG development among those individuals and organizations that might profit directly from CBNG and those that would not. Those who own land or mineral rights where CBNG could be developed tend to favor cautious and prudent development for the economic benefits it could bring to them and the local economies. Some who do not stand

to benefit directly also favor responsible CBNG development as soon as possible, believing the economic benefits are needed urgently to bolster stagnant or failing local economies and in turn help maintain existing rural lifestyles. Particularly in the less affluent portions of the study area, CBNG and other resource development may be seen as one of the few means to meet urgent human needs in the form of employment and income.

Other individuals, including those who do not stand to benefit directly from CBNG, are concerned that the quality of their life and the environment will be adversely affected; that local benefits will be minor; and that most of the benefits will accrue to outsiders. There is a perception that such outside developers, or "wildcatters," will move into a community, extract the profits, and leave a despoiled environment behind. Rural residents, including those in small developments or neighborhoods, are generally concerned about the potential for CBNG development in adjacent areas to disturb the peaceful and pristine setting, to contribute unsightly development, to disturb wildlife, and to threaten the provision of adequate public services.

There is also a perception from some comments that CBNG will adversely affect the lifestyles of the Native Americans living in and around the 13-county Planning Area—particularly those on the reservations. Concerns reflect the traditional high value placed on natural resources by these groups, the importance of existing water and other natural resources in tribal economies and cultures, and the opinion that tribal members will be unduly burdened with the costs of development while not receiving many or any benefits.

Public Comments from SEIS Scoping Process (2005)

Scoping comments received in the summer of 2005 reflect similar concerns about and support for CBNG development as those expressed during scoping for the Statewide Document. In addition, there was a concern that delayed or phased development would create economic impacts. Specifically, lessees and lessors would lose revenue due to leasing and permitting delays and the state would have a net present value loss in income and payroll taxes, as well as production taxes and royalties. There were also concerns about the displacement of wildlife to livestock grazing tracts, the subsequent interference with livestock grazing, and the potential effect on sub-irrigated tracts.

Newspaper Reports

One of the largest newspapers in the Planning Area, the *Billings Gazette,* was reviewed for information about local attitudes and concerns related to the socioeconomics of CBNG. During the week of February 19, 2001, the *Billings Gazette* presented an in-depth report on CBNG development in Wyoming and Montana. While the series was running, readers were invited to register their opinions about the positive and negative aspects of CBNG in the Powder River Basin. Because this was not a scientific or statistical survey, the responses are likely to be biased toward those who had a concern or issue to communicate.

Of the 154 responses received, 94 agreed with the statement, "Coal bed methane development will be detrimental to Montana's environment and shouldn't be developed here." Thirty-seven respondents agreed with the statement, "Coal bed methane should be developed in Montana with regulation to reduce negative affects on water and other land uses," and 23 selected the statement, "Coal bed methane will bring jobs and money to Montana and should be developed as soon as possible." (*Billings Gazette* 2001.) Thus, roughly one-third of the respondents supported CBNG development and two-thirds did not. A number of other written comments were published, which generally reflect the diversity of opinions described previously in the public comments section.

The results of a poll conducted by Montana State University at Billings were reported in the *Billings Gazette* on November 14, 2001. Of the respondents to this poll, 63 percent indicated support for CBNG in Montana if reasonable precautions were taken to protect the environment. Of the remainder of those polled, 11 percent indicated that CBNG should not be developed, 11 percent indicated it should be developed as quickly as possible, and 15 percent were undecided.

The Coalbed Natural Gas Alliance conducted a poll in the fall of 2004, and the results were reported in an article published by the *Billings Gazette* on January 19, 2005. The survey involved 450 landowners from a mailing list generated by six of the area's largest CBNG producers (Marathon, Devon, Huber, Fidelity, Yates Petroleum, and Nance). Of those responding to the survey, 36 percent said that the overall impact of CBNG development on their community has been "very positive," while 77 percent responded between "very positive" and "neutral." For a similar question regarding effects of CBNG development on the environment, 47 percent responded either "positive" or "neutral" and 32 percent responded "somewhat

negative." The article also presented comments on the survey from the director of the Powder River Basin Resource Council and a ranch owner. Their comments indicated that the survey results contradicted what they have experienced with ranchers and landowners.

Attitudes Toward Public Lands

Attitudes about general social conditions and about U.S. Bureau of Land Management's (BLM's) management of public lands in eastern Montana were gathered by Trent (1991) in interviews with about 100 residents. The results are summarized here from the discussion in the *Big Dry RMP/EIS* (BLM 1995). The residents indicated the most important aspects of their area and community were the outdoors and wide open spaces, good people, a small town atmosphere, keeping the community alive, the ability to earn a living, enjoying outdoor recreation, and, finally, that the area is a good place to raise children.

In relation to use and management of public lands, many of the respondents stated the importance of multiple uses and support for resource protection while allowing a variety of activities on public lands. Vegetation and soils were identified as the resources most important to protect, with livestock grazing and hunting the most favored activities. Recreation was slightly less favored and oil/gas, coal, and other mineral development were less favored than recreation. Concern about local economic conditions was predominant among the respondents. Respondents were concerned about the livestock industry, citing it as the most threatened activity on public lands. The respondents also were concerned with resource protection and preserving special resource values such as wildlife habitat, riparian areas, and wetlands.

Another summary of attitudes toward public lands and resource management is provided in the *Off-Highway Vehicle Final EIS* (U.S. Department of the Interior [USDI] 2001). The document states that social values for lands and natural resources take many forms, such as commodity, amenity, environmental quality, ecology, public use, spiritual, health, and security. In the past, natural resource management tended to emphasize commodity values. An emerging emphasis is a shift from commodities and services to environments and habitats. At the same time, in places where land use has been unrestricted, there is increasing concern by some that new regulations and uses are driving out traditional uses such as livestock grazing and off-highway vehicle use.

Oil and Gas Development

Other past data on attitudes toward oil and gas development is contained in the report "Natural Resource Development in Montana" (Wallwork and Johnson 1986). The discussion here is summarized from the *Final Oil and Gas RMP/EIS Amendment for Billings, Powder River and South Dakota* (1992). The original study consisted of interviews with 624 Montana adults. Nearly two-thirds of the respondents indicated natural resource development, in general, to be essential to the State's future economic health. The primary benefits were construed to be jobs and income, help the state and local economy, tax revenues, and the provision of needed products. Respondents indicated the primary costs or disadvantages associated with natural resource development would be environmental impacts, pollution, poor reclamation, population growth, and boom-and-bust economic cycles. About three-fifths of the respondents saw little or no conflict between natural resource development and outdoor recreation, while one-fourth felt that the two activities did conflict.

Most respondents in the 1986 interviews felt the following activities should be allowed on government lands: timber cutting (85 percent approval); oil and gas extraction (83 percent); coal mining (78 percent); and hardrock mining (79 percent). Some respondents felt the following activities should be prohibited on government lands: timber cutting (11 percent disapproval); oil and gas extraction (12 percent); coal mining (17 percent); and hard rock mining (15 percent). In response to specific questions about oil and gas leasing and development, about half the respondents felt oil and gas development to be essential to Montana's future economic health, with a higher percentage of respondents in eastern Montana feeling this way. Another third of the respondents indicated oil and gas development to be fairly essential. Responses to the pace of development were evenly split, with nearly 40 percent responding that it was just right and 40 percent feeling it was too slow. Nearly 75 percent of the respondents said they had a favorable impression of the industry. About two-fifths of the eastern Montana respondents rated the industry excellent or pretty good in its behavior as a responsible citizen of the state. Another two-fifths of these respondents rated the industry as only fair or poor in its behavior as a responsible state citizen.

Northern Cheyenne and Crow Tribes

Attitudes toward coal development among the members of the Northern Cheyenne and Crow tribes are described in the Economic, Social and Cultural Supplement to the *Powder River I Regional Draft EIS* (BLM 1989). While there may be differences in attitudes between coal development and natural gas (CBNG), there are also likely to be similarities.

Northern Cheyenne attitudes toward coal development are complex. In general, tribal members have shown a determination to maximize the potential benefits of coal development (such as training and employment opportunities and possible revenue sources) and to minimize the potential adverse effects (such as air quality degradation and increased demand on tribal facilities and services). In spite of the conflict it causes with traditional values and attitudes toward land and resources, many tribal members felt that if mining is going to occur in the area anyway, then the tribe and its members should try to reap some of its benefits as well as bear some of its costs. However, other Northern Cheyenne, particularly some of the more traditional elders, were firmly against energy development because of its disruption to the land and environment. They recognized that there is a need for jobs on the reservation but felt that other jobs that were less disruptive to the land and traditional values must be found.

The attitudes of individual Northern Cheyenne members toward coal development off the reservation reflected their perceptions about whether, and to what extent, they or their friends and family were benefiting from it. Those who were benefiting from coal-related employment or who aspired to do so seemed to be in favor of this development. Those who had been refused coal-related jobs or were not interested in them felt less positive about regional coal development. Many cited both positive effects (mostly jobs) and negative effects (environmental pollution, increased traffic, and drug and alcohol problems) that they believed were associated with the coal mines and power plants that had been constructed since 1970.

For residents of the Crow Reservation, a high level of concern was found regarding the impact that off-reservation coal development could have on the reservation. Three major concerns emerged regarding off-reservation coal development: 1) that it would compete with the marketing and development of on-reservation coal; 2) that reservation services and infrastructure would be affected and experience fiscal shortfalls; and 3) that regional coal development could have an impact on Crow culture and individual behavior such as alcohol and drug abuse. Specific cultural concerns included potential loss or dilution of culture values such as sharing and the importance of family as a result of the exposure to non-Native American values.

Many people on the Crow Reservation, including tribal officials, expressed the concern that federal coal would compete directly with tribal-owned coal. If federal coal is leased, then tribal-owned coal is less likely to be leased. Tribal coal leasing was seen by some members as a way for the tribe to raise money to save its land base and to enhance the tribe's ability to govern itself. If the tribe can generate its own revenues, it can determine how that money is spent and will no longer have to depend on the federal government to address problems.

See the section **Public Comments from SEIS Scoping Process (2005)** for a discussion regarding tribal concerns related to socioeconomic impacts from CBNG development.

Government Revenue Sources

Total county revenues for fiscal years 1999 and 2004 are presented in Table SEA-1. The table shows that the total revenues collected in the 13 Planning Area counties accounted for 21.0 percent of the revenues collected by all of the counties in the State in 1999 and 16.3 percent in 2004. By comparison, the Planning Area population was 21.8 percent of the state total in 2000.

Taxes

Total taxes collected by counties are shown in Table SEA-1. With some exceptions, taxes account for a large share—often about one half—of total county revenue. Counties that are less reliant on tax revenues have other miscellaneous income or intergovernmental income, generally related to natural resources rents or royalties.

Property Taxes and Assessed Value

Property taxes are levied by counties on real property and on any specified facilities and/or improvements to that real property.

The assessed value, taxable value, and total property taxes collected for the state and each study area county in 2000 are presented in Table SEA-2. The average mill levy rate for each county is also shown. Property taxes collected in the 13 study-area counties totaled more than $182 million, which is 23.0 percent of the state total. The percentage of property taxes collected in the study area is consistent with the study area population, which was similarly 21.8 percent of the state total in 2000. The taxes collected in the counties vary widely in accordance with the assessed values, taxable values, and tax rates and mill levies in each county.

Table SEA-4 shows the assessed value, taxable value, and total property taxes and fees collected in 2004 for each of the 13 counties in the study area. Total property taxes collected increased over 30 percent from 2000; however, the total of $239 million constituted 23.6 percent of the state total, which is similar to the proportion observed in 2000. Much of increase in property taxes came from Big Horn and Yellowstone counties, while smaller increases occurred for Carbon, Custer, Rosebud, Stillwater, and Sweet Grass counties. Total property taxes collected for the other counties in the study area were relatively unchanged between 2000 and 2004.

Natural Resource Taxes

Natural resource taxes were a relatively small component of total tax revenues, at $100 million or 6.5 percent. Natural resource taxes include taxes on coal, oil, natural gas, and metals mining. Table SEA-4 shows the State oil and natural gas tax revenues for 1999 and 2000. Total natural gas revenues were $11,205,901 in 2000—an increase of 8.1 percent from the previous year—while total oil revenues were $32,564,421—an increase of 59.1 percent from 1999. For both oil and natural gas, revenues in 2000 were 42.0 percent higher than 1999.

As shown in Table SEA-1, county revenues from oil and natural gas production taxes and the percent of these revenues compared to total county revenues varied greatly among the 13 study-area counties. For a number of the counties, the income was minimal or zero. The exceptions include Blaine County ($626,111 or 15.7 percent of county revenue), Carbon County ($178,443 or 4.1 percent) and Musselshell County ($256,627 or 7.1 percent). (Note: The Oil and Gas Production Tax [LGST] was eliminated after 1999.)

Oil and natural gas production tax revenues collected by the state of Montana from 1999 through 2004 are shown in Table SEA-5. While oil and natural gas revenues increased substantially in 2000 and 2001, 2002 revenues were markedly lower. In 2003 and 2004, the state share of these revenues has surpassed the 2002 total, while the local share remains below the 2002 high.

TABLE SEA-1

TOTAL COUNTY REVENUES BY SOURCE, FISCAL YEARS 1999[1] AND 2004

	Revenue Source	Amount (1999)	% of County Total (1999)	Amount (2004)	% of County Total (2004)
Big Horn County	Taxes	$4,481,631	44.6%	$4,098,456	38.9%
	Licenses and Permits	$114,511	1.1%	$5,020	0.0%
	Intergovernmental	$1,235,480	12.3%	$3,226,513	30.7%
	Oil and Gas Production Tax (LGST) **(Included in Intergovernmental above)**	$5,280	0.1%		
	Charges for Services	$1,364,573	13.6%	$2,224,803	21.1%
	Fines and Forfeitures	$115,996	1.2%	$104,961	1.0%
	Miscellaneous Revenue	$2,090,577	20.8%	$779,100	7.4%
	Investment Earnings	$643,663	6.4%	$84,096	0.8%
	Total:	$10,046,431	100.0%	$10,522,949	100.0%
Carbon County	Taxes	$2,243,839	51.8%	$2,832,181	53.0%
	Licenses and Permits	$158,176	3.7%	$23,010	0.4%
	Intergovernmental	$1,441,197	33.3%	$2,020,479	37.8%
	Oil and Gas Production Tax (LGST) **(Included in Intergovernmental above)**	$178,443	4.1%		
	Charges for Services	$196,394	4.5%	$264,928	5.0%
	Fines and Forfeitures	$62,692	1.4%	$71,730	1.3%
	Miscellaneous Revenue	$62,203	1.4%	$68,384	1.3%
	Investment Earnings	$164,215	3.8%	$64,181	1.2%
	Total:	$4,328,716	100.0%	$5,344,893	100.0%
Carter County	Taxes	$1,026,167	53.9%	$1,503,686	61.9%
	Licenses and Permits	$20,765	1.1%	$80	0.0%
	Intergovernmental	$267,473	14.1%	$614,190	25.3%
	Oil and Gas Production Tax (LGST) **(Included in Intergovernmental above)**				
	Charges for Services	$100,220	5.3%	$191,450	7.9%
	Fines and Forfeitures	$6,569	0.3%	$6,238	0.3%
	Miscellaneous Revenue	$399,562	21.0%	$85,202	3.5%
	Investment Earnings	$82,130	4.3%	$29,395	1.2%
	Total:	$1,902,886	100.0%	$2,430,241	100.0%

TABLE SEA-1

TOTAL COUNTY REVENUES BY SOURCE, FISCAL YEARS 1999[1] AND 2004

	Revenue Source	Amount (1999)	% of County Total (1999)	Amount (2004)	% of County Total (2004)
Custer County	Taxes	$2,327,867	49.8%	$2,865,221	52.7%
	Licenses and Permits	$110,737	2.4%	$1,930	0.0%
	Intergovernmental	$1,042,529	22.3%	$1,519,309	28.0%
	Oil and Gas Production Tax (LGST) **(Included in Intergovernmental above)**	$41,434	0.9%		
	Charges for Services	$484,733	10.4%	$634,756	11.7%
	Fines and Forfeitures	$68,931	1.5%	$71,477	1.3%
	Miscellaneous Revenue	$471,159	10.1%	$257,342	4.7%
	Investment Earnings	$163,813	3.5%	$84,131	1.5%
	Total:	$4,669,769	100.0%	$5,434,166	100.0%
Golden Valley County	Taxes	$387,137	57.0%	$426,703	52.0%
	Licenses and Permits	$13,242	1.9%	$480	0.1%
	Intergovernmental	$174,519	25.7%	$286,189	34.9%
	Oil and Gas Production Tax (LGST) **(Included in Intergovernmental above)**	$6,415	0.9%		
	Charges for Services	$22,560	3.3%	$29,886	3.6%
	Fines and Forfeitures	$13,219	1.9%	$10,484	1.3%
	Miscellaneous Revenue	$4,967	0.7%	$3,903	0.5%
	Investment Earnings	$63,575	9.4%	$62,381	7.6%
	Total:	$679,219	100.0%	$820,026	100.0%
Musselshell County	Taxes	$1,084,288	30.1%	$1,305,277	37.0%
	Licenses and Permits	$73,915	2.0%	$1,835	0.1%
	Intergovernmental	$739,530	20.5%	$1,616,815	45.9%
	Oil and Gas Production Tax (LGST) **(Included in Intergovernmental above)**	$256,627	7.1%		
	Charges for Services	$256,627	7.1%	$354,328	10.1%
	Fines and Forfeitures	$35,272	1.0%	$77,828	2.2%
	Miscellaneous Revenue	$1,287,222	35.7%	$89,835	2.5%
	Investment Earnings	$130,944	3.6%	$79,074	2.2%
	Total:	$3,607,798	100.0%	$3,524,992	100.0%

TABLE SEA-1

TOTAL COUNTY REVENUES BY SOURCE, FISCAL YEARS 1999[1] AND 2004

	Revenue Source	Amount (1999)	% of County Total (1999)	Amount (2004)	% of County Total (2004)
Powder River County	Taxes	$1,193,285	37.7%	$1,732,413	37.8%
	Licenses and Permits	$44,235	1.4%	$905	0.0%
	Intergovernmental	$586,548	18.5%	$1,174,272	25.6%
	Oil and Gas Production Tax (LGST) **(Included in Intergovernmental above)**	$89,261	2.8%		
	Charges for Services	$1,177,971	37.2%	$1,555,757	33.9%
	Fines and Forfeitures	$29,218	0.9%	$42,180	0.9%
	Miscellaneous Revenue	$50,028	1.6%	$52,971	1.2%
	Investment Earnings	$86,243	2.7%	$29,086	0.6%
	Total:	$3,167,528	100.0%	$4,587,584	100.0%
Rosebud County	Taxes	$3,736,882	50.7%	$2,417,614	32.2%
	Licenses and Permits	$96,804	1.3%	$1,450	0.0%
	Intergovernmental	$1,627,917	22.1%	$3,574,494	47.6%
	Oil and Gas Production Tax (LGST) **(Included in Intergovernmental above)**	$14,024	0.2%		
	Charges for Services	$642,491	8.7%	$1,132,386	15.1%
	Fines and Forfeitures	$86,111	1.2%	$61,590	0.8%
	Miscellaneous Revenue	$824,751	11.2%	$80,518	1.1%
	Investment Earnings	$349,646	4.7%	$249,154	3.3%
	Total:	$7,364,602	100.0%	$7,517,206	100.0%
Stillwater County	Taxes	$2,302,415	8.3%	$2,365,085	51.5%
	Licenses and Permits	$338,758	1.2%	$17,420	0.4%
	Intergovernmental	$24,113,855	86.8%	$1,177,398	25.7%
	Oil and Gas Production Tax (LGST) **(Included in Intergovernmental above)**	$11,326	0.0%		
	Charges for Services	$256,559	0.9%	$717,346	15.6%
	Fines and Forfeitures	$101,596	0.4%	$115,777	2.5%
	Miscellaneous Revenue	$445,202	1.6%	$163,371	3.6%
	Investment Earnings	$215,360	0.8%	$33,644	0.7%
	Total:	$27,773,745	100.0%	$4,590,041	100.0%

TABLE SEA-1

TOTAL COUNTY REVENUES BY SOURCE, FISCAL YEARS 1999[1] AND 2004

	Revenue Source	Amount (1999)	% of County Total (1999)	Amount (2004)	% of County Total (2004)
Sweet Grass County	Taxes	No Report Received		$2,082,286	22.1%
	Licenses and Permits			$345	0.0%
	Intergovernmental			$2,366,927	25.1%
	Oil and Gas Production Tax (LGST) **(Included in Intergovernmental above)**				
	Charges for Services			$4,247,320	45.0%
	Fines and Forfeitures			$56,549	0.6%
	Miscellaneous Revenue			$640,310	6.8%
	Investment Earnings			$41,322	0.4%
	Total:			$9,435,059	100.0%
Treasure County	Taxes	$422,269	60.4%	$474,025	52.8%
	Licenses and Permits	$16,076	2.3%		
	Intergovernmental	$124,734	17.8%	$259,193	28.9%
	Oil and Gas Production Tax (LGST) **(Included in Intergovernmental above)**				
	Charges for Services	$46,933	6.7%	$87,309	9.7%
	Fines and Forfeitures	$47,409	6.8%	$19,906	2.2%
	Miscellaneous Revenue	$16,561	2.4%	$48,112	5.4%
	Investment Earnings	$25,710	3.7%	$8,568	1.0%
	Total:	$699,692	100.0%	$897,113	100.0%
Wheatland County	Taxes	$20,477	0.84%	$1,141,255	59.7%
	Licenses and Permits	$240,304	9.9%		
	Intergovernmental	$132,438	5.4%	$520,918	27.2%
	Oil and Gas Production Tax (LGST) **(Included in Intergovernmental above)**				
	Charges for Services	$25,717	1.06%	$182,543	9.5%
	Fines and Forfeitures	$416,588	17.2%	$18,068	0.9%
	Miscellaneous Revenue	$22,246	0.92%	$10,066	0.5%
	Investment Earnings	$1,557,462	64.5%	$38,797	2.0%
	Total:	$2,415,232	100.0%	$1,911,647	100.0%

TABLE SEA-1

TOTAL COUNTY REVENUES BY SOURCE, FISCAL YEARS 1999[1] AND 2004

	Revenue Source	Amount (1999)	% of County Total (1999)	Amount (2004)	% of County Total (2004)
Yellowstone County	Taxes	$16,996,908	44.1%	$20,549,931	49.2%
	Licenses and Permits	$2,732,460	7.1%	$3,482,605	8.3%
	Intergovernmental	$7,946,773	20.6%	$6,345,544	15.2%
	Oil and Gas Production Tax (LGST) **(Included in Intergovernmental above)**	$5,155	0.0%		
	Charges for Services	$8,757,415	22.7%	$10,103,632	24.2%
	Fines and Forfeitures	$676,103	1.8%	$737,145	1.8%
	Miscellaneous Revenue	$240,406	0.6%	$251,641	0.6%
	Investment Earnings	$1,232,920	3.2%	$260,324	0.6%
	Total:	$38,582,985	100.0%	$41,730,822	100.0%
Study Area Total[2]		**119,820,279**		**$98,746,739**	
% of State Total		**21.0%**		**16.3%**	
Montana State Total		**569,806,112**		**604,483,926**	

Source: Montana Department of Commerce, Billings (2000, 2006).
[1]Based on unaudited data reported by Counties.
[2]1999 total does not include Sweet Grass County (no data available).

TABLE SEA-2

ASSESSED VALUES AND PROPERTY TAX COLLECTIONS BY COUNTY (2000)

	2000 Assessed Value	2000 Taxable Value	Total Property Taxes and fees Collected	Average Mill Levy
Big Horn County	$565,023,700	$21,354,436	$6,952,144	293.77
Carbon County	$521,678,159	$23,754,742	$9,288,300	349.51
Carter County	$120,132,817	$6,808,649	$2,382,143	329.01
Custer County	$371,459,345	$14,389,152	$8,806,856	460.53
Golden Valley County	$98,470,244	$5,687,402	$1,784,283	305.79
Musselshell County	$179,355,501	$6,881,914	$3,173,428	393.23
Powder River County	$125,672,599	$4,415,991	$2,227,445	463.94
Rosebud County	$1,957,565,773	$100,635,100	$20,804,541	173.34
Stillwater County	$697,014,674	$28,705,444	$10,708,053	319.89
Sweet Grass County	$247,083,525	$9,532,599	$3,677,085	354.74
Treasure County	$86,217,475	$4,306,117	$1,646,795	329.73
Wheatland County	$162,260,802	$10,468,500	$3,263,418	297.22
Yellowstone County	$5,245,460,701	$204,127,734	$107,952,414	378.48
Study Area Total	**$10,377,395,315**	**$441,067,780**	**$182,666,905**	--
% of State Total	**no data**	**26.3%**	**23.0%**	--
Montana	**no data**	**$1,679,739,857**	**$794,598,177**	--

Source: Montana Department of Revenue (2000).

TABLE SEA-3

ASSESSED VALUES AND PROPERTY TAX COLLECTIONS BY COUNTY (2004)

	2004 Assessed Value	2004 Taxable Value	Total Property Taxes and fees Collected
Big Horn County	$509,234,496	$19,071,825	$13,500,559
Carbon County	$604,545,613	$24,558,032	$12,059,295
Carter County	$128,295,092	$10,269,939	$3,692,825
Custer County	$395,219,177	$14,165,809	$11,267,038
Golden Valley County	$94,613,026	$4,919,186	$1,905,042
Musselshell County	$200,581,108	$6,560,315	$3,949,930
Powder River County	$119,338,454	$4,005,441	$2,554,997
Rosebud County	$1,676,984,323	$84,867,600	$22,071,869
Stillwater County	$767,840,416	$28,823,824	$12,852,966
Sweet Grass County	$447,045,426	$14,688,014	$6,087,181
Treasure County	$82,736,041	$3,932,398	$1,780,852
Wheatland County	$152,027,561	$9,001,462	$3,497,120
Yellowstone County	$6,077,895,654	$215,714,493	$143,708,149
Study Area Total	**$11,256,356,387**	**$440,578,338**	**$238,927,823**
% of State Total	**22.8%**	**24.8%**	**23.6%**
Montana	**$49,450,862,550**	**$1,779,929,986**	**$1,014,487,652**

Source: Montana Department of Revenue (2004).

TABLE SEA-4

MONTANA OIL AND NATURAL GAS PRODUCTION TAX REVENUES (1999 AND 2000)

	1999	2000	% Change 1999-2000
Natural Gas Tax Revenues	$10,367,718	$11,205,901	8.1%
% of Total	33.6%	25.6%	
Oil Tax Revenues	$20,461,684	$32,564,421	59.1%
% of Total	66.4%	74.4%	
Total	**$30,829,402**	**$43,770,322**	**42.0%**

Source: Montana Department of Revenue (2000).

TABLE SEA-5

MONTANA OIL AND NATURAL GAS PRODUCTION TAX REVENUES (1999 THROUGH 2004)

	1999	2000	2001	2002	2003	2004
Total State Share	$9,221,612	$13,817,290	$31,392,351	$15,837,967	$30,894,533	$47,712,085
% Change from Previous Year		49.8%	127.2%	-49.5%	95.1%	54.4%
Total Local Share	$21,607,789	$29,953,032	$61,425,763	$34,465,644	$42,494,843	$44,963,964
% Change from Previous Year		38.6%	105.1%	-43.9%	23.3%	5.8%
Total	**$30,829,401**	**$43,770,322**	**$92,818,114**	**$50,303,611**	**$73,389,376**	**$92,676,049**
% Increase from Previous Year		42.0%	112.1%	-45.8%	45.9%	26.3%

Source: Montana Department of Revenue (2004).

SOILS APPENDIX

SOILS APPENDIX

The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Services (NRCS) has published a general soil association map for Montana in digital format. The State Soil Geographic Database (STATSGO) (USDA NRCS 1996) provides a general overview of soils distribution and occurrences in the planning area, at a 1:250,000 scale and is not suitable for site-specific evaluations. More detailed information is available from Soil Survey Geographic Databases (SSURGO) at http://www.ncgc.nrcs.usda.gov/products/datasets/ssurgo/index.html. General soils information presented in the State Soil Geographic Database (STATSGO) is presented in the *Soils Technical Report* (ALL 2001a). Information presented includes the areal extent, soil series characteristics, K-factor (erosion potential), salinity, and sodium adsorption ratio (SAR) for the various soil groups in the Powder River RMP and Billings RMP areas. The *Soils Technical Report* was prepared to present the potential impacts from the coal bed natural gas (CBNG) extraction process on land and the environment, with a focus on impacts to agriculture, and including potential effects on crops, livestock, and soils. The report was used to prepare this section and provides more detailed information pertaining to soils and CBNG development impacts to the environment. The complete Soils Technical Report can be accessed at http://www.mt.blm.gov/mcfo.

The layout of the soils in the study area is shown in Figures SOI-1 and SOI-2 for the Billings Resource Management Plan (RMP) Area and Powder River RMP area, respectively. A total of 163 soil mapping units composed of 205 soil series are present in the two RMP areas. The seven principal soil mapping units based on areal extent within the two RMP areas are:

- MT421 Cambeth-Megonot-Manning (4.3 percent)
- MT089 Yamac-Birney-Cabbart (4.3 percent)
- MT676 Yawdim-Delpoint-Thurlow (4.0 percent)
- MT675 Cabbart-Yawdim-Thurlow (3.9 percent)
- MT384 Marvan-Neldore-Bascovy (3.5 percent)
- MT103 Cabbart-Delpoint-Yamac (3.0 percent)
- MT559 Tanna-Rentsac-Yawdim (2.9 percent)

These seven soil mapping units compose 26 percent of the two RMP areas, with the remaining 156 soil mapping units making up the remainder. Table SOI-1 presents all of the soil mapping units in the Billings RMP and Powder River RMP areas, along with the percent of the total RMP areas occupied by each mapping unit. Table SOI-2 presents some of the key soil characteristics related to erosion and salinity for the topmost 25 mapping units based on percent of total area.

Soils in the RMP areas are derived mainly from sedimentary bedrock and alluvium. The soils generally range from loams to clays, but are principally loams to silty clay loams.

Slope and K-factor are values that are used in the estimation of soil erosion potential. Slope values range up to greater than 40 percent; however, there are many soils that have slopes of zero to about 10 percent. Almost all of the soils have low K-factors (below 0.37). Easily eroded soils have a K-factor between 0.37 and 0.69, and resistant soils have a K-factor less than 0.37 (Jarrett 1995). Figures presenting the mean K-factor of the soils in the Billings RMP and Powder River RMP areas are included in the *Soils Technical Report* (ALL 2001). Figures SOI-1 and SOI-2 are included here to summarize the information.

Soil salinity affects the suitability of a soil for crop production and the stability of the soil. The SAR is the measure of sodium relative to calcium and magnesium, and affects the soil structure and infiltration rate of water. The *Soils Technical Report* presents a more detailed discussion pertaining to the salinity and SAR of the soils in the Billings RMP and Powder River RMP areas. As shown in Table SOI-2, most of the soils are very low in salinity. The SAR values in the study areas and statewide vary widely and, with few exceptions, are low in sodium. Based on the generally fine texture of the surface soils (clayey), much of the soil will likely be susceptible to increasing sodicity when irrigated with water having a high SAR. Permeability is the measure of vertical water movement when the soil is saturated. The soil structure, porosity, gradation and texture all influence the permeability of the soil. Those soils with a coarser texture (sandy to loamy) and good internal drainage (higher permeability) will be the least susceptible to increasing sodicity and salinity. Much of the soil is likely to be irrigable with good management.

TABLE SOIL-1
AREAL EXTENT OF SOIL MAP UNITS FOR POWDER RIVER AND BILLINGS RMP AREAS

STATSGO Map Unit	Map Unit Name	Acres	Percent of Area
MT001	Abac-Peritsa-Rock Outcrop	93,754	0.48
MT003	Absarokee-Castner-Sinnigam	436,268	2.25
MT004	Absarokee-Wayden-Redcreek Family	23,322	0.12
MT006	Absarokee-Castner-Grail	15,901	0.08
MT007	Absarokee-Hilger-Big Timber	70,560	0.36
MT016	Winler-Lismas-Swanboy	21,332	0.11
MT017	Archin-Twilight-Bonfri	78,323	0.4
MT019	Assinniboine-Pring-Archin	459,121	2.37
MT024	Badland-Bullock-Neldore	129,347	0.67
MT027	Bainville-Mcrae-Rock Outcrop	453,939	2.35
MT028	Bainville-Rock Outcrop-Travessilla	205,254	1.06
MT029	Bainville-Travessilla Family-Evanston	171,636	0.89
MT037	Beauvais-Hydro-Lambeth	83,773	0.43
MT041	Bew-Toluca-Nobe	8,032	0.04
MT042	Big Timber-Cabba-Absarokee	107,565	0.56
MT048	Bitton-Shambo-Doney	428,667	2.22
MT051	Blackhall-Twilight-Zeona	21,144	0.11
MT054	Cabbart-Bonfri-Cambeth	2	<0.01
MT055	Bonfri-Gerdrum-Galbreth	3,927	0.02
MT070	Bryant-Doney-Shambo	56,522	0.29
MT075	Yamac-Busby-Cabbart	104,872	0.54
MT076	Cabba-Travessilla Family-Birney	121,597	0.63
MT078	Cabba-Campspass-Farland	6,969	0.04
MT080	Cabba-Farland-Yawdim	38,170	0.2
MT083	Cabba-Ringling-Yawdim	300,378	1.55
MT084	Cabba-Ringling-Yawdim	493,159	2.55
MT089	Yamac-Birney-Cabbart	827,152	4.27
MT090	Cabbart-Cambeth-Bonfri	183,942	0.95
MT092	Delpoint-Cabbart-Yamac	552,861	2.86

TABLE SOIL-1
AREAL EXTENT OF SOIL MAP UNITS FOR POWDER RIVER AND BILLINGS RMP AREAS

STATSGO Map Unit	Map Unit Name	Acres	Percent of Area
MT095	Cabbart-Keiser-Dast	57,076	0.29
MT096	Cabbart-Pultney Family-Stormitt	43,281	0.22
MT097	Cabbart-Rentsac-Delpoint	283,471	1.46
MT099	Cabbart-Rock Outcrop-Twilight	116,567	0.6
MT100	Cabbart-Twilight-Forelle	31,738	0.16
MT103	Cabbart-Delpoint-Yamac	577,016	2.98
MT112	Castner-Savage-Chama	5,667	0.03
MT113	Castner-Chama-Regent	4,089	0.02
MT114	Castner-Darret-Windham	3	<0.01
MT120	Wayden-Castner-Cabba	47,803	0.25
MT127	Chinook-Archin-Delpoint	6	<0.01
MT145	Crago-Musselshell-Attewan	545,006	2.82
MT146	Crago-Musselshell-Fairfield	7,046	0.04
MT148	Creed-Gerdrum-Forelle	1,072	0.01
MT152	Cushman-Yawdim-Bainville	54,706	0.28
MT153	Danvers-Tinsley-Oburn	72,675	0.38
MT155	Danvers-Judith-Windham	49,063	0.25
MT157	Dast-Forelle-Delpoint	31,137	0.16
MT159	Dast-Mcrae-Travessilla Family	84,373	0.44
MT161	Degrand-Kremlin-Ethridge	10,319	0.05
MT164	Cabbart-Delpoint-Yamac	278,907	1.44
MT165	Delpoint Family-Kirby-Delpoint	33,440	0.17
MT167	Delpoint-Travessilla Family-Cabbart	216,026	1.12
MT168	Delpoint-Cabbart-Yamac	105,771	0.55
MT173	Dolus-Boxwell-Castner	22,680	0.12
MT174	Doney-Reeder-Cabba	72,377	0.37
MT175	Doney-Shaak-Wayden	232,912	1.2
MT176	Doney-Winifred-Wayden	73,711	0.38
MT182	Starley-Rock Outcrop-Babb	147,700	0.76

TABLE SOIL-1
AREAL EXTENT OF SOIL MAP UNITS FOR POWDER RIVER AND BILLINGS RMP AREAS

STATSGO Map Unit	Map Unit Name	Acres	Percent of Area
MT187	Ethridge-Kremlin-Marias	9,089	0.05
MT190	Evanston-Lonna-Tinsley	19,800	0.1
MT193	Fairway Family-Tetonview-Villy	8,546	0.04
MT209	Forkwood-Vonalee-Haverdad	31,675	0.16
MT213	Garlet-Cowood-Rock Outcrop	298	<0.01
MT216	Garlet-Rubble Land-Cowood	2,132	0.01
MT217	Garlet-Sebud-Cheadle	22,544	0.12
MT218	Shadow-Garlet-Macfarlane	257,150	1.33
MT224	Gerdrum-Forelle-Archin	38,201	0.2
MT225	Harlem-Gerdrum-Ethridge	26,205	0.14
MT228	Gilt Edge-Absher-Yawdim	11,675	0.06
MT247	Harlem-Vanda-Marvan	10,450	0.05
MT249	Stormitt-Harvey Family-Nihill	48,815	0.25
MT252	Haverson-Heldt-Toluca	16,832	0.09
MT254	Havre-Glendive-Water	30,577	0.16
MT255	Havre-Harlem-Attewan	25,454	0.13
MT256	Havre-Harlem-Glendive	88,473	0.46
MT258	Havre-Ryell-Harlem	50,431	0.26
MT259	Havre-Hanly-Glendive	173,933	0.9
MT261	Havre-Rivra-Water	114,549	0.59
MT263	Havre-Kobar-Spinekop	47,424	0.25
MT264	Havre-Glendive-Yamac	10,938	0.06
MT269	Heath-Charlos-Maurice	58,449	0.3
MT271	Heldt-Fort Collins-Kobar	43,967	0.23
MT273	Helmville-Whitore-Tropal	126,307	0.65
MT301	Keiser-Hydro-Gilt Edge	112,102	0.58
MT309	Kobar-Yamac-Attewan	23,490	0.12
MT321	Lamedeer-Ringling-Twin Creek	35,383	0.18
MT323	Lap-Windham-Armington	104,714	0.54

TABLE SOIL-1
AREAL EXTENT OF SOIL MAP UNITS FOR POWDER RIVER AND BILLINGS RMP AREAS

STATSGO Map Unit	Map Unit Name	Acres	Percent of Area
MT324	Lardell-Mckenzie-Kobar	28,542	0.15
MT327	Libeg-Leavitt-Hanson	17,866	0.09
MT336	Lihen-Delpoint-Tinsley	5,762	0.03
MT338	Lisam-Abor-Vanda	303,030	1.57
MT339	Lisam-Abor-Hesper	28,331	0.15
MT349	Lolo-Work-Shawa	39,683	0.21
MT365	Maginnis-Absarokee-Rock Outcrop	116,071	0.6
MT369	Marias-Havre-Harlem	143,781	0.74
MT374	Martinsdale-Fairfield-Reeder	7	<0.01
MT379	Marvan-Abor-Neldore	97,192	0.5
MT382	Marvan-Gerdrum-Vanda	200,503	1.04
MT383	Harlem-Vanda-Marvan	23,594	0.12
MT384	Marvan-Neldore-Bascovy	677,263	3.5
MT393	Mcrae-Harlem-Keiser	103,536	0.54
MT396	Midway-Shingle-Rock Outcrop	76,447	0.4
MT400	Mirror-Bross-Vasquez	56,548	0.29
MT407	Moyerson-Rock Outcrop-Orinoco	253,541	1.31
MT414	Neldore-Abor-Vanda	7,787	0.04
MT415	Neldore-Abor-Volborg	93,856	0.49
MT421	Cambeth-Megonot-Manning	829,387	4.29
MT433	Nunn-Toluca-Heldt	5,480	0.03
MT438	Bridger-Bynum-Owen Creek	16,109	0.08
MT456	Pinelli-Glendive-Busby	4,780	0.02
MT459	Prospect-Sublette-Teton	9,292	0.05
MT466	Reeder Family-Barvon-Mowbray	136,554	0.71
MT471	Rentsac-Cabbart-Blackhall	24,662	0.13
MT472	Yawdim-Rentsac-Lambeth	149,344	0.77
MT474	Broadus-Ridge-Cabba	42,375	0.22
MT475	Ringling-Cabba-Relan	16,537	0.09

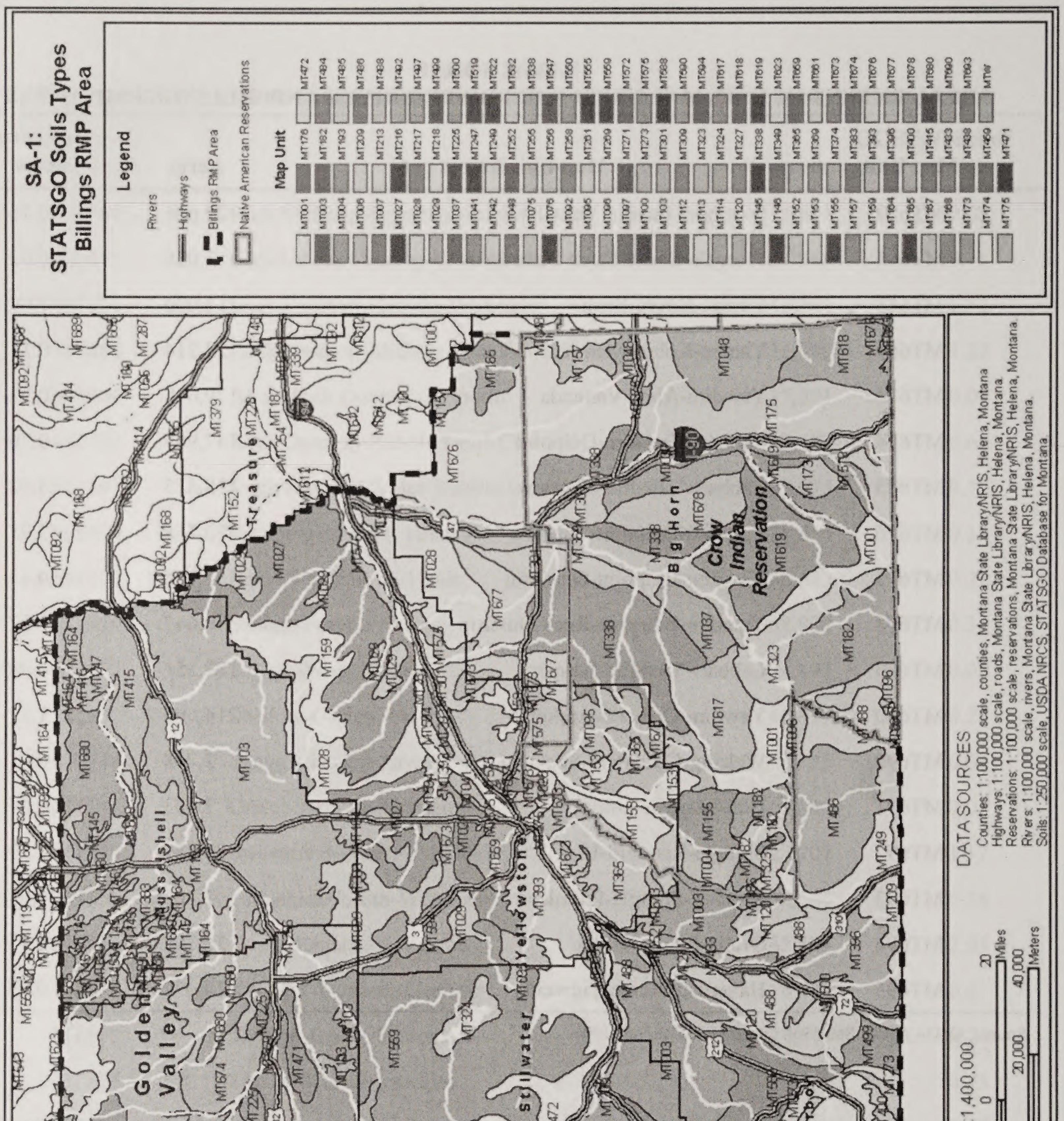
TABLE SOIL-1
AREAL EXTENT OF SOIL MAP UNITS FOR POWDER RIVER AND BILLINGS RMP AREAS

STATSGO Map Unit	Map Unit Name	Acres	Percent of Area
MT484	Rock Outcrop-Dryadine-Rubble Land	3,611	0.02
MT485	Garlet-Rock Outcrop-Cryoborolls	21,066	0.11
MT486	Rock Outcrop-Hanson-Whitecow	159,584	0.82
MT488	Rock Outcrop-Midway-Travessilla Family	236,799	1.22
MT489	Abor-Rock Outcrop-Delpoint	17,571	0.09
MT492	Rock Outcrop-Rubble Land-Cowood	127,770	0.66
MT497	Rock Outcrop-Water-Rubble Land	68,075	0.35
MT499	Romberg-Calicott-Hiland	28,655	0.15
MT500	Romberg-Naturita-Heldt	40,683	0.21
MT519	Savage-Forelle-Frazer	68,982	0.36
MT522	Savage-Work-Chama	4,497	0.02
MT532	Shadow-Garlet-Water	48,413	0.25
MT538	Skaggs-Starley-Raynesford	25	<0.01
MT547	Garlet-Stemple-Tigeron	1,244	0.01
MT550	Sweetgrass-Hilger-Fairfield	227,202	1.17
MT555	Tamaneen-Judith-Windham	53,564	0.28
MT559	Tanna-Rentsac-Yawdim	567,531	2.93
MT569	Yawdim-Thurlow-Cabbart	116,568	0.6
MT572	Tigeron-Garlet-Worock	142,349	0.74
MT575	Tinsley-Keiser-Yawdim	141,874	0.73
MT588	Work-Turner-Wayden	149,865	0.77
MT590	Twilight-Blackhall-Busby	22,004	0.11
MT594	Vananda-Gerdrum-Mckenzie	60,705	0.31
MT597	Vanstel-Cabbart-Delpoint	72,598	0.38
MT612	Wanetta-Hesper-Bitton	30,042	0.16
MT617	Wayden-Abac-Rock Outcrop	91,333	0.47
MT618	Wayden-Regent-Doney	82,113	0.42
MT619	Wayden-Eltsac-Maschetah	186,591	0.96
MT623	Whitecow-Mocmont-Hughesville	41,880	0.22

TABLE SOIL-1
AREAL EXTENT OF SOIL MAP UNITS FOR POWDER RIVER AND BILLINGS RMP AREAS

STATSGO Map Unit	Map Unit Name	Acres	Percent of Area
MT659	Wormser-Lavina-Yawdim	29,616	0.15
MT661	Worock-Garlet-Rock Outcrop	3,050	0.02
MT668	Yamac-Havre-Birney	211,006	1.09
MT669	Yamac-Kobar-Marvan	22,214	0.11
MT673	Yawdim-Abor-Vananda	179,618	0.93
MT674	Cabbart-Yawdim-Delpoint	147,969	0.76
MT675	Cabbart-Yawdim-Thurlow	758,425	3.92
MT676	Yawdim-Delpoint-Thurlow	770,758	3.98
MT677	Yawdim-Delpoint-Gerdrum	82,348	0.43
MT678	Yawdim-Ethridge-Rock Outcrop	70,647	0.37
MT679	Cabbart-Yawdim-Hesper	189,351	0.98
MT680	Yawdim-Orinoco-Amherst	214,696	1.11
MT690	Welring-Clifterson-Shavano	2,718	0.01
MT691	Ulm-Maggin-Louviers	7,403	0.04
MT692	Shingle-Renohill-Ulm	36,589	0.19
MT693	Samday-Shingle-Parmleed	7,705	0.04
MT694	Orella-Epsie-Winler	26,102	0.13
MT695	Haverdad-Havre-Zigweid	14,472	0.07

Source: USDA NRSC State Soil Geographic Database 1996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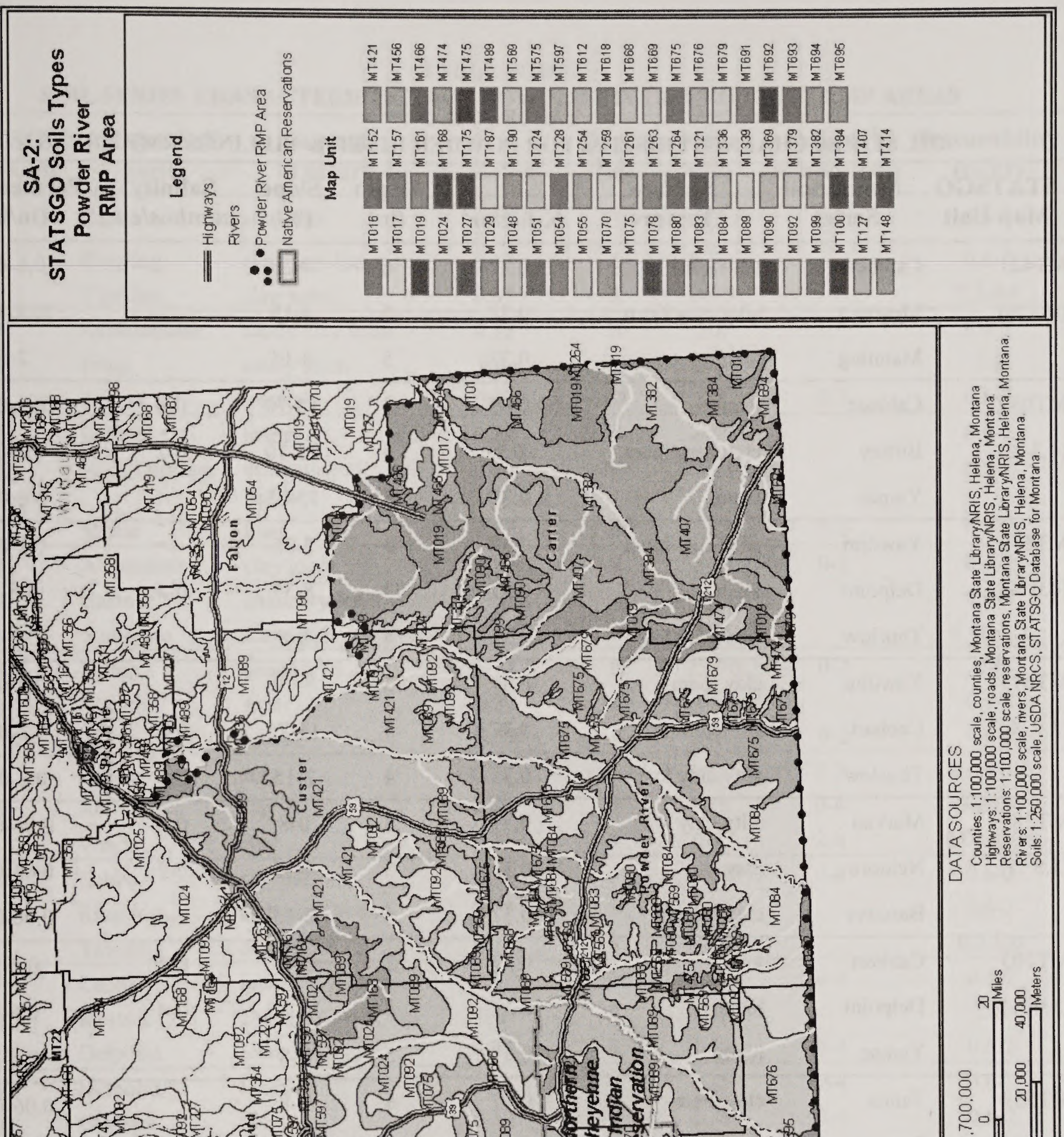
STATSGO Soils Types
Billings RMP Area
Legend
Rivers
Highways
Billings RMP Area
Native American Reservations
Map Unit
DATA SOURCES
Counties: 1:100,000 scale, counties, Montana State Library/NRIS, Helena, Montana
Highways: 1:100,000 scale, roads, Montana State Library/NRIS, Helena, Montana.
Reservations: 1:100,000 scale, reservations, Montana State Library/NRIS, Helena, Montana.
Rivers: 1:100,000 scale, rivers, Montana State Library/NRIS, Helena, Montana.
Soils: 1:250,000 scale, USDA NRCS, STATSGO Database for Montana.
1:1,400,000
Miles
Meters
Golden Valley
Wheatland
Sweet Grass
Stillwater
Yellowstone
Musselshell
Treasure
Big Horn
Carbon
Crow Indian Reservation


SA-2:
STATSGO Soils Types
Powder River
RMP Area
Legend
Highways
Rivers
Powder River RMP Area
Native American Reservations
Map Unit
MT016
MT017
MT019
MT024
MT027
MT029
MT048
MT051
MT054
MT055
MT070
MT075
MT078
MT080
MT083
MT084
MT089
MT090
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MT612
MT618
MT668
MT669
MT675
MT676
MT679
MT691
MT692
MT693
MT694
MT695
Fallon
Carter
Custer
Powder River
Rosebud
Treasure
Big Horn
Northern Cheyenne Indian Reservation
Crow Indian Reservation
DATA SOURCES
Counties: 1:100,000 scale, counties, Montana State Library/NRIS, Helena, Montana
Highways: 1:100,000 scale, roads, Montana State Library/NRIS, Helena, Montana
Reservations: 1:100,000 scale, reservations, Montana State Library/NRIS, Helena, Montana.
Rivers: 1:100,000 scale, rivers, Montana State Library/NRIS, Helena, Montana.
Soils: 1:250,000 scale, USDA NRCS, STATSGO Database for Montana
1:1,700,000
20 10 0 20 Miles
20,000 10,000 0 20,000 40,000 Meters

TABLE SOIL-2
SOIL SERIES CHARACTERISTICS FOR POWDER RIVER & BILLINGS RMP AREAS

STATSGO Map Unit	Major Soil Series	Surface Texture	K-factor[1]	Depth (in)	Slope (%)	Salinity[2] (mmhos/cm)	Permeability (in/hr)
MT421	Cambeth	silt loam	0.37	6	4-25		0.6-0.2
(4.3 %)	Megonot	silty clay loam	0.37	5	4-15		0.06-0.2
	Manning	loam	0.32	5	8-15		2-6
MT089	Cabbart	loam	0.37	3	15-70	0-4	0.6-0.2
(4.3 %)	Birney	channery loam	0.2	5	25-70	0-2	0.6-0.2
	Yamac	loam	0.37	5	15-25		0.6-0.2
MT676	Yawdim	silty clay loam	0.37	3	8-35		0.2-0.6
(4.0 %)	Delpoint	loam	0.37	3	8-35	0-4	0.6-2
	Thurlow	silty clay loam	0.32	4	0-8		0.6-2
MT675	Yawdim	clay loam	0.37	3	8-70		0.2-0.6
(3.9 %)	Cabbart	silt loam	0.37	3	15-75	0-4	0.2-0.6
	Thurlow	silty clay loam	0.32	4	2-15		0.2-0.6
MT384	Marvan	silty clay	0.37	4	0-8	0-4	0.06-0.2
(3.5 %)	Neldore	clay	0.32	3	4-15	0-2	0.06-0.2
	Bascovy	clay	0.37	6	2-15	2-4	0.06-0.2
MT103	Cabbart	loam	0.37	3	6-45	0-4	0.6-2
(3.0 %)	Delpoint	loam	0.37	3	15-35	0-4	0.6-2
	Yamac	loam	0.37	5	2-8		0.6-2
MT559	Tanna	clay loam	0.37	6	2-8		0.06-0.2
(2.9 %)	Rentsac	channery loam	0.2	7	4-15		0.6-2
	Yawdim	clay loam	0.37	3	25-60		0.2-0.6
MT092	Cabbart	loam	0.37	3	8-70	0-4	0.6-2
(2.9 %)	Delpoint	loam	0.37	3	15-25	0-4	0.6-2
	Yamac	loam	0.37	5	2-8		0.6-2
MT145	Crago	loam	0.37	4	0-4		0.6-2
(2.8%)	Musselshell	loam	0.37	3	0-2		0.6-2
	Attewan	loam	0.37	6	0-2		0.6-2

TABLE SOIL-2
SOIL SERIES CHARACTERISTICS FOR POWDER RIVER & BILLINGS RMP AREAS

STATSGO Map Unit	Major Soil Series	Surface Texture	K-factor[1]	Depth (in)	Slope (%)	Salinity[2] (mmhos/cm)	Permeability (in/hr)
MT084	Cabba	silt loam	0.37	3	15-50	0-4	0.6-2
(2.6 %)	Ringling	channery-loam	0.17	5	5-50		0.6-2
	Yawdim	clay loam	0.37	3	8-70		0.2-0.6
MT019	Assinniboine	sandy clay loam	0.32	6	2-8		0.6-2
(2.4 %)	Pring	sandy loam	0.2	10	2-8		2-6
	Archin	loam	0.43	12	2-8	0-2	0.6-2
MT027	Bainville	loam	0.37	4	2-15		0.6-2
(2.4 %)	Rock Outcrop	unweathered bedrock	0	60	25-60		0.6-2
	Mcrae	loam	0.37	5	7-15	0-2	0.6-2
MT003	Absarokee	clay loam	0.32	8	2-50	0-2	0.6-2
(2.3 %)	Castner	channery loam	0.2	6	15-50		0.6-2
	Sinnigam	clay loam	0.37	6	2-15		0.06-0.2
MT048	Bitton	channery loam	0.24	11	25-70	0-2	2-6
(2.2 %)	Shambo	loam	0.37	5	0-8		0.6-2
	Doney	loam	0.37	4	2-70	0-2	0.6-2
MT338	Lisam	clay	0.37	3	4-35	0-2	0.06-0.2
(1.6 %)	Abor	clay	0.37	6	4-15	0-4	0.2-0.6
	Vanda	clay	0.37	4	0-8	2-8	0.01-0.06
MT083	Cabba	silt loam	0.37	3	15-50	0-4	0.6-2
(1.6 %)	Ringling	channery loam	0.17	5	6-50		0.6-2
	Yawdim	clay loam	0.37	3	8-70		0.2-0.6
MT097	Cabbart	loam	0.37	3	8-35	0-4	0.6-2
(1.5 %)	Rentsac	channery loam	0.2	7	8-35		2-6
	Delpoint	loam	0.37	3	8-15	0-4	0.6-2
MT164	Delpoint	loam	0.37	3	2-15	0-4	0.6-2
(1.4 %)	Cabbart	loam	0.37	3	2-35	0-4	0.6-2
	Yamac	loam	0.37	5	2-15		0.6-2
MT218	Shadow	very channery loam	0.1	3	25-60		2-6
(1.3 %)	Macfarlane	extremely stony loam	0.05	18	25-50		2-6
	Garlet	stony loam	0.2	4	25-60		0.6-2
MT407	Moyerson	silty clay loam	0.32	4	4-50	0-4	0.06-0.2
(1.3 %)	Orinoco	silty clay loam	0.32	7	2-15		0.2-0.6
	Rock Outcrop	unweathered bedrock	0	60	0-99		0.2-0.6

TABLE SOIL-2
SOIL SERIES CHARACTERISTICS FOR POWDER RIVER & BILLINGS RMP AREAS

STATSGO Map Unit	Major Soil Series	Surface Texture	K-factor[1]	Depth (in)	Slope (%)	Salinity[2] (mmhos/cm)	Permeability (in/hr)
MT488	Midway	silty clay loam	0.43	3	15-45	2-4	0.2-0.6
(1.2 %)	Travessilla Family	silt loam	0.32	2	15-70		0.6-2
	Rock Outcrop	unweathered bedrock	0	60	0-99		0.6-2
MT175	Doney	loam	0.37	4	8-70	0-2	0.6-2
(1.2 %)	Wayden	silty clay loam	0.37	6	8-35	0-4	0.6-2
	Shaak	clay loam	0.37	6	1-15		0.06-0.2
MT550	Sweetgrass	gravelly loam	0.17	4	0-4		0.6-2
(1.2 %)	Hilger	very stony loam	0.2	5	2-4		0.6-2
	Fairfield	clay loam	0.17	7	2-4		0.6-2
MT167	Travessilla Family	fine sandy loam	0.2	2	8-35		2-6
(1.1 %)	Delpoint	loam	0.37	3	8-15	0-4	0.6-2
	Cabbart	loam	0.37	3	8-35	0-4	0.6-2
MT680	Yawdim	silty clay	0.32	3	4-15		0.06-0.2
(1.1 %)	Orinoco	silty clay	0.28	7	4-15		0.2-0.6
	Amherst	clay loam	0.32	5	1-15		0.6-2
MT668	Yamac	loam	0.37	5	0-8		0.6-2
(1.1 %)	Havre	silty clay loam	0.32	8	0-2	0-2	0.2-0.6
	Birney	channery-loam	0.2	5	15-35	0-2	0.6-2

Source: USDA NRCS State Soil Geographic Database 1996

Note: Only the top 25 Map Units based on total acreage are included (percent in parenthesis). 58 percent of the soils in the study area are represented.

[1] Soil erosion factor indicates the susceptibility of a soil to sheet and rill erosion. Possible range of values is from 0.02 to 0.69, with higher values being more susceptible to erosion.

[2] Measure of the amount of soluble salts in a soil at saturation, also expressed as electrical conductivity (EC).

SOLID AND HAZARDOUS WASTE APPENDIX

SOLID AND HAZARDOUS WASTE APPENDIX

The Toxics Release Inventory (TRI) provides state reports about releases and transfers of chemicals and compounds. Each report contains overall state information regarding releases and transfers, a list of the top five chemicals released or transferred, off-site, in that state, and a list of the top ten facilities that released or transferred, off-site, the greatest amount of chemicals. All chemical and facility information was taken directly from the Envirofacts TRI database maintained by the U.S. Environmental Protection Agency (EPA).

TRI State Report Descriptions

This is a brief description of the TRI State Reports. A brief explanation of each column heading is given.

State Information

This is general TRI information relating to the state.

- Total Facilities—The total facilities reporting in that state.
- Total Forms—The total number of forms submitted. Each form has a unique Document Control Number.
- Total Forms A's—The total number of short forms submitted.
- Transfer into State—The total amount of waste chemicals (in pounds) transferred into the state.
- Transfer out of State—The total amount of waste chemicals (in pounds) transferred out of the state.
- Population—The population of a state as reported by the U.S. Census Bureau for 1990.

Reported Releases and Waste Management Activities

On-Site Releases

The amount of chemicals released as reported by facilities in that state.

- Air Emissions—Total on-site releases of a particular type in pounds where the environmental medium = 'AIR'.
- Surface Water Discharges—Total on-site releases of a particular type in pounds where the environmental medium = 'WATER'.
- Underground Injection—Total on-site releases of a particular type in pounds where the environmental medium = 'UNINJ I' or 'UNINJ IIV'.
  - Class I Wells—Total on-site releases of a particular type in pounds where the environmental medium = 'UNINJ I'.
  - Class II-V Wells—Total on-site releases of a particular type in pounds where the environmental medium = 'UNINJ IIV'.
- Releases to Land—Total on-site releases of a particular type in pounds where the environmental medium = 'RCRA C' or 'OTH LANDF'.
  - RCRA Subtitle C Landfills—Total on-site releases of a particular type in pounds where the environmental medium = 'RCRA C'.
  - Other On-Site Land Releases—Total on-site releases of a particular type in pounds where the environmental medium = 'OTH LANDF'.
- Total On-Site Releases—The sum of Air Emissions, Surfaces Water Discharges, Underground Injection, and Releases to Land.
- Transfer Off-Site to Disposal—Total off-site transfer of a particular type in pounds for disposal.
- Total On and Off-Site Releases—Sum of total on-site releases and off-site transfers.

Off-Site Releases (Transfers Off-Site to Disposal)

- POTWs (metals and metal compounds)—Total transfer of metals and metal compounds in pounds to POTWs as offsite releases.

- Transfer Off-Site to Disposal—Total off-site transfer of a particular type in pounds for disposal.
- Total Off-Site Releases—Sum of total POTW's (metals and metal compounds) and off-site transfers to disposals.
- Total Releases—Sum of total on-site and off-site releases.

Source Reduction Activities

- Energy Recovery On-Site—The total amount of the toxic chemical in waste burned for energy recovery onsite, reported in section 8.2 of Form R.
- Energy Recovery Off-Site—The total amount of the toxic chemical in waste sent offsite to be burned for energy recovery, reported in section 8.3 of Form R.
- Recycling On-Site—The total amount of the toxic chemical recycled onsite, reported in section 8.4 of Form R.
- Recycling Off-Site—The total amount of the toxic chemical sent offsite for recycling, reported in section 8.5 of Form R.
- Treatment On-Site—The total amount of the toxic chemical treated onsite, reported in section 8.6 of Form R.
- Treatment Off-Site—The total amount of the toxic chemical treated offsite, reported in section 8.7 of Form R.
- Total Releases—The total amount of the toxic chemical released due to production related events by the facility to all environmental media both on and off site, reported in section 8.1 of Form R.
- Total Production Related Waste Managed—The sum of recycling, energy recovery, treatment, and total releases.

Transfers Off-Site to POTW's

- Metals and Metal Compounds—Total transfer of metals and metals compounds in pounds to POTW's as an off-site releases.
- Non-Metal TRI Chemicals—Total off-site transfer of non-metals in pounds to a POTW's as an off-site release.
- Total Transfers Off-site to POTW's—Sum of total off-site transfers of Metals and Non-Metals to POTW's.

Top Ten Chemicals for Air/Water/Land/Underground Injection Releases and the Top Ten Chemicals for Total On and Off-Site Releases

The waste chemicals that are most released into the environment for that state.

- Chemical—The name of the chemical.
- Air Emissions—Total on-site releases of a particular type in pounds where the environmental medium = 'AIR'.
- Surface Water Discharges—Total on-site releases of a particular type in pounds where the environmental medium = 'WATER'.
- Underground Injection—Total on-site releases of a particular type in pounds where the environmental medium = 'UNINJ I' or 'UNINJ IIV'.
  - Class I Wells—Total on-site releases of a particular type in pounds where the environmental medium = 'UNINJ I'.
  - Class II-V Wells—Total on-site releases of a particular type in pounds where the environmental medium = 'UNINJ IIV'.
- Releases to Lands—Total on-site releases of a particular type in pounds where the environmental medium = 'RCRA C' or 'OTH LANDF'.
  - RCRA Subtitle C Landfills—Total on-site releases of a particular type in pounds where the environmental medium = 'RCRA C'.
  - Other On-Site Land Release—Total on-site releases of a particular type in pounds where the environmental medium = 'OTH LANDF'.
- Total On-site Releases—The sum of Air Emissions, Surfaces Water Discharges, Underground Injection, and Releases to Land.

- Transfers Off-Site to Disposal—Total off-site transfer of a particular type in pounds for disposal.
- Total On and Off-site Releases—Sum of total on-site releases and off-site transfers.

Top Ten Facilities for Air/Water/Land/Underground Injection Releases and the Top Ten Facilities for Total On and Off-site Release

The facilities that release the most waste chemicals into the environment for that state.

- Facility—The name of the facility.
- City, County—The city name and the county name where the facility is located.
- Air Emissions—Total on-site releases in pounds by a facility where the environmental medium = 'AIR'.
- Surface Water Discharge—Total on-site releases in pounds by a facility where the environmental medium = 'WATER'.
- Underground Injection—Total on-site releases in pounds by a facility where the environmental medium = 'UNINJ I' or 'UNINJ IIV'.
  - Class I Wells—Total on-site releases in pounds by a facility where the environmental medium = 'UNINJ I'.
  - Class II-V Wells—Total on-site releases in pounds by a facility where the environmental medium = 'UNINJ IIV'.
- Releases to Land—Total on-site releases in pounds by a facility where the environmental medium = 'RCRA C' or 'OTH LANDF'.
  - RCRA Subtitle C Landfills—Total on-site releases in pounds by a facility where the environmental medium = 'RCRA C'.
  - Other On-Site Land Releases—Total on-site releases in pounds by a facility where the environmental medium = 'OTH LANDF'.
- Total On-site Releases—The sum of Air Emissions, Surfaces Water Discharges, Underground Injection, and Releases to Land by a facility.
- Transfers Off-Site to Disposal—Total off-site transfer in pounds for disposal by a facility.
- Total On and Off-site Releases—Sum of total on-site releases and off-site transfers by a facility.

The following table contains the EPA's Toxics Release Inventory information for Montana for the year 2001 (2001 is the latest year for which a published report is available). More recent information up to year 2003 is available from EPA's website at: http://www.epa.gov/triexplorer/.

2001 Toxics Release Inventory — MONTANA

Reported Releases and Other Waste Management Activities (in pounds)

	Total
On-site Releases	62,744,079
Air Emissions	4,292,997
Surface Water Discharges	48,785
Underground Injection Class I Wells	0
Underground Injection Class II-V Wells	369,092
On-site Land Releases to RCRA Subtitle C Landfills	2,395
Other On-site Land Releases	58,030,810
Off-site Releases (Transfers Off-site to Disposal)*	2,644,099
Total On- and Off-site Releases	**65,388,178**
Recycled On-site	8,626,607
Recycled Off-site	62,534
Energy Recovery On-site	3,948,532
Energy Recovery Off-site	41,063
Treated On-site	10,499,243
Treated Off-site**	36,449
Quantity Released On- and Off-site***	51,214,536
Total Production-related Waste Managed	**74,428,965**
Non-production-related Waste Managed	**12,029,507**

Transfers Off-site for Further Waste Management, Including Disposal

Recycling	102,939
Energy Recovery	36,638
Treatment	39,313
Publicly Owned Treatment Works (POTWs)	1,619
Metals and Metal Category Compounds*	14
Non-metal TRI Chemicals**	1,605
Other Off-site Transfers****	227,840
Transfers Off-site to Disposal *(not including metals to POTWs)*	2,808,061
Total Transfers Off-site for Further Waste Management, Including Disposal	**3,216,411**

* Transfers to POTWs of metals and metal category compounds are included in off-site releases. Excludes transfer amounts sent for disposal to other TRI facilities reporting that amount released on-site.
** Transfers to POTWs of non-metals are included in treated off-site waste management activity.
*** Excludes non-production-related releases; e.g. releases due to catastrophic events or remedial actions.
**** Transfers reported without a valid waste management code.

For More Information . . .

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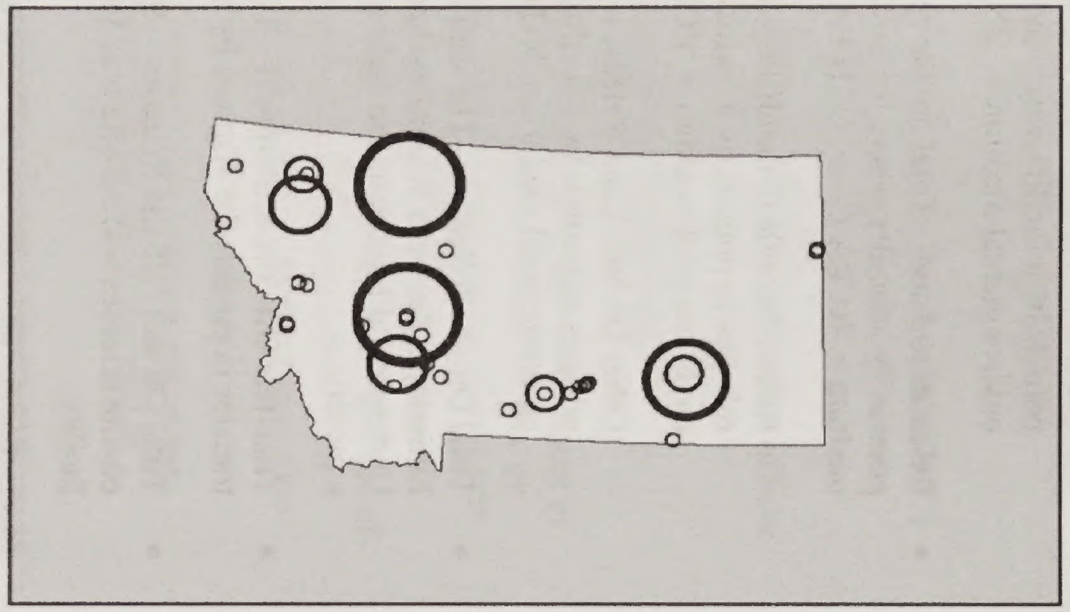
To obtain TRI data use assistance, call TRI User Support Service (TRI-US):
(202) 566-0250
tri.us@epa.gov



The largest circle in the state map represents the largest facility for on-site releases in the state of Montana. All circles are proportionally-sized to represent the on-site releases at each facility within this state.

State/TRI Data	
Population	905,382
Square Miles	145,556
Total Facilities	49
Total Forms	293
Form As	34

	Total
National Rank for Total On- and Off-site Releases*	
Rank	25
Pounds	65,388,178
National Rank for Total On-site Releases**	
Rank	25
Pounds	62,744,079
National Rank for Total Releases within State***	
Rank	25
Pounds	63,507,964
National Rank for Production-related Waste Managed	
Rank	44
Pounds	74,428,965

* Includes transfers out-of-state for disposal. Excludes transfer amounts sent for disposal to other TRI facilities reporting that amount released on-site.
** Includes amounts released at the facility. Excludes amounts transferred to other sites.
*** Excludes transfers for disposal sent out-of-state or sent to other TRI facilities within the state reporting that amount released on-site.

2001 Toxics Release Inventory

MONTANA

On-site and Off-site Releases for Top Five Chemicals Ranked on Total Releases in the State (All Chemicals)

		On-site Releases				Off-site Releases		Off-site Transfers to Disposal		
CAS Number	Chemical	Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Pounds	On-site Releases to Land Pounds	Transfers Off-site to Disposal* Pounds	Total Releases in the State** Pounds	Transferred Into State Pounds	Transferred Within State Pounds	Transferred Out of State Pounds
—	Zinc compounds	6,624	14	0	24,009,658	763,254	24,779,550	92,100	1,555	761,699
—	Lead compounds	6,913	349	10,813	14,054,719	791,161	14,863,955	48,301	7,297	783,864
—	Barium compounds	89,853	5	0	8,290,628	278,000	8,658,486	0	278,000	0
—	Copper compounds	12,595	10	47,757	3,385,422	40,273	3,486,057	19,800	23,677	16,596
—	Manganese compounds	10,975	24,006	0	2,855,009	48,827	2,938,817	150	47,505	1,322

On-site and Off-site Releases for PBT Chemicals Ranked on Total Releases in the State

		On-site Releases				Off-site Releases		Off-site Transfers to Disposal		
CAS Number	Chemical	Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection Pounds	On-site Releases to Land Pounds	Transfers Off-site to Disposal* Pounds	Total Releases in the State** Pounds	Transferred Into State Pounds	Transferred Within State Pounds	Transferred Out of State Pounds
—	Lead compounds	6,913.38	349.20	10,813.00	14,054,718.70	791,160.58	14,863,954.86	48,301.20	7,296.90	783,863.68
7439-92-1	Lead	327.70	24.00	0.00	82,820.00	1,238.40	84,410.10	0.00	1,238.40	0.00
—	Mercury compounds	1,772.40	0.04	18.00	7,159.50	426.41	9,376.35	0.00	31.00	395.41
—	Polycyclic aromatic compounds	2,213.19	7.00	0.00	885.80	50.90	3,156.89	0.00	22.90	28.00
7439-97-6	Mercury	69.80	2.40	0.00	430.80	6.80	509.80	0.00	6.80	0.00
191-24-2	Benzo(g,h,i)perylene	153.71	0.00	0.00	0.30	2.20	156.21	0.00	1.80	0.40
118-74-1	Hexachlorobenzene	11.70	0.00	0.00	0.00	0.00	11.70	0.00	0.00	0.00
—	Dioxin and dioxin-like compounds	0.04	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
—	*Dioxin and dioxin-like compounds (in grams)*	*17.593*	*0.162*	*0.000*	*0.049*	*0.152*	*17.956*	*0.000*	*0.152*	*0.000*
309-00-2	Aldrin	—***	—	—	—	—	—	—	—	—
57-74-9	Chlordane	—***	—	—	—	—	—	—	—	—
76-44-8	Heptachlor	—***	—	—	—	—	—	—	—	—
465-73-6	Isodrin	—***	—	—	—	—	—	—	—	—
72-43-5	Methoxychlor	—***	—	—	—	—	—	—	—	—
29082-74-4	Octachlorostyrene	—***	—	—	—	—	—	—	—	—
40487-42-1	Pendimethalin	—***	—	—	—	—	—	—	—	—
608-93-5	Pentachlorobenzene	—***	—	—	—	—	—	—	—	—
1336-36-3	Polychlorinated biphenyls (PCBs)	—***	—	—	—	—	—	—	—	—
79-94-7	Tetrabromobisphenol A	—***	—	—	—	—	—	—	—	—
8001-35-2	Toxaphene	—***	—	—	—	—	—	—	—	—
1582-09-8	Trifluralin	—***	—	—	—	—	—	—	—	—

* Excludes amounts transferred to other TRI facilities in the state reporting that amount released on-site.

** The chemical ranking is based on the amounts in this column.

*** No reports were submitted for these chemicals.

2001 Toxics Release Inventory

MONTANA

On-site and Off-site Releases for Top Ten Facilities Ranked on Total On-site Releases in the State (All Chemicals)

Facility, City, County	On-site Releases: Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection: Class I Wells Pounds	Underground Injection: Class II-V Wells Pounds	On-site Releases to Land: RCRA Subtitle C Landfills Pounds	On-site Releases to Land: Other On-site Land Releases Pounds	Total On-site Releases* Pounds	Off-site Releases (Transfers Off-site to Disposal): Transferred Within State Pounds	Transferred Out of State Pounds
Montana Tunnels Mining Inc., Jefferson City, Jefferson	9,850	0	0	0	0	23,633,174	23,643,024	0	0
ASARCO Inc., East Helena, Lewis And Clark	12,252	166	0	0	0	20,063,922	20,076,340	0	2,194,380
Colstrip Steam Electric Station, Colstrip, Rosebud	286,163	0	0	0	0	10,819,248	11,105,411	254,951	25
Golden Sunlight Mines Inc., Whitehall, Jefferson	54,580	0	0	0	0	2,548,199	2,602,779	0	0
Stone Container Corp., Missoula, Missoula	1,443,054	32,691	0	0	0	31,419	1,507,164	670	255
Colstrip Energy L.P. Rosebud Power Plant, Colstrip, Rosebud	585,297	0	0	0	0	171,592	756,889	0	0
SMC Nye Mine Site, Nye, Stillwater	21	0	0	369,092	0	362,498	731,611	175,148	1
Plum Creek Mdf Inc., Columbia Falls, Flathead	697,550	0	0	0	0	0	697,550	0	0
Conoco Inc. Billings Refy., Billings, Yellowstone	236,466	306	0	0	0	0	236,772	0	0
Stillwater Mining Co. East Boulder Ops., Big Timber, Sweet Grass	247	0	0	0	0	225,583	225,830	0	0

On-site and Off-site Releases for Top Ten Facilities Ranked on Total On-site Releases in the State (PBT Chemicals)

Facility, City, County	On-site Releases: Air Emissions Pounds	Surface Water Discharges Pounds	Underground Injection: Class I Wells Pounds	Underground Injection: Class II-V Wells Pounds	On-site Releases to Land: RCRA Subtitle C Landfills Pounds	On-site Releases to Land: Other On-site Land Releases Pounds	Total On-site Releases* Pounds	Off-site Releases (Transfers Off-site to Disposal): Transferred Within State Pounds	Transferred Out of State Pounds
Montana Tunnels Mining Inc., Jefferson City, Jefferson	169.20	0.00	0.00	0.00	0.00	8,187,629.00	8,187,798.20	0.00	0.00
ASARCO Inc., East Helena, Lewis And Clark	4,336.00	1.00	0.00	0.00	0.00	5,776,075.00	5,780,412.00	0.00	784,237.00
Golden Sunlight Mines Inc., Whitehall, Jefferson	8.10	0.00	0.00	0.00	0.00	82,429.00	82,437.10	0.00	0.00
Colstrip Steam Electric Station, Colstrip, Rosebud	1,728.46	0.00	0.00	0.00	0.00	54,348.00	56,076.46	701.00	5.12
SMC Nye Mine Site, Nye, Stillwater	0.87	0.00	0.00	10,831.00	0.00	19,498.00	30,329.87	4,949.00	1.00
Colstrip Energy L.P. Rosebud Power Plant, Colstrip, Rosebud	1,627.00	0.00	0.00	0.00	0.00	13,473.00	15,100.00	0.00	0.00
Stillwater Mining Co. East Boulder Ops., Big Timber, Sweet Grass	9.00	0.00	0.00	0.00	0.00	9,295.00	9,304.00	0.00	0.00
Columbia Falls Aluminum Co. L.L.C., Columbia Falls, Flathead	1,501.00	0.00	0.00	0.00	0.00	743.00	2,244.00	0.00	0.00
Lewis & Clark Station, Sidney, Richland	85.00	26.40	0.00	0.00	0.00	824.40	935.80	1,058.00	0.00
Stone Container Corp., Missoula, Missoula	190.90	351.20	0.00	0.00	0.00	153.60	695.70	664.80	0.00

* The facility ranking is based on the amounts in this column; these quantities exclude transfers out of state.

2001 Toxics Release Inventory — MONTANA

Total Production-related Waste for Top Ten Facilities Ranked on Quantity Released On- and Off-site (All Chemicals)

Facility, City, County	Recycled On-site Pounds	Recycled Off-site Pounds	Energy Recovery On-site Pounds	Energy Recovery Off-site Pounds	Treated On-site Pounds	Treated Off-site Pounds	Quantity Released On- and Off-site* Pounds	Total Production-related Waste Managed Pounds	Total Non-Production-related Waste Managed Pounds
Montana Tunnels Mining Inc., Jefferson City, Jefferson	0	25,815	0	0	0	0	20,682,625	20,708,440	702,662
Colstrip Steam Electric Station, Colstrip, Rosebud	0	1,601	0	0	2,500,000	474	11,344,890	13,846,966	0
ASARCO Inc., East Helena, Lewis And Clark	6,898,619	0	0	0	0	0	10,944,629	17,843,248	11,326,091
Golden Sunlight Mines Inc., Whitehall, Jefferson	0	0	0	0	0	0	2,579,389	2,579,389	0
Stone Container Corp., Missoula, Missoula	0	0	3,470,000	428	2,840,891	1	1,499,381	7,810,700	0
SMC Nye Mine Site, Nye, Stillwater	423	0	0	0	23,096	0	906,760	930,279	0
Colstrip Energy L.P. Rosebud Power Plant, Colstrip, Rosebud	0	0	0	0	0	0	756,889	756,889	0
Plum Creek Mdf Inc., Columbia Falls, Flathead	0	0	0	0	0	0	696,300	696,300	0
Conoco Inc. Billings Refy., Billings, Yellowstone	0	50	0	0	9,020	4,305	236,773	250,148	0
Stillwater Mining Co. East Boulder Ops., Big Timber, Sweet Grass	0	0	0	0	0	0	225,830	225,830	0

Total Production-related Waste for Top Ten Facilities Ranked on Quantity Released On- and Off-site (PBT Chemicals)

Facility, City, County	Recycled On-site Pounds	Recycled Off-site Pounds	Energy Recovery On-site Pounds	Energy Recovery Off-site Pounds	Treated On-site Pounds	Treated Off-site Pounds	Quantity Released On- and Off-site* Pounds	Total Production-related Waste Managed Pounds	Total Non-Production-related Waste Managed Pounds
Montana Tunnels Mining Inc., Jefferson City, Jefferson	0.00	0.00	0.00	0.00	0.00	0.00	5,491,146.00	5,491,146.00	443,932.00
ASARCO Inc., East Helena, Lewis And Clark	4,643,364.00	0.00	0.00	0.00	0.00	0.00	1,322,530.00	5,965,894.00	5,242,119.00
Golden Sunlight Mines Inc., Whitehall, Jefferson	0.00	0.00	0.00	0.00	0.00	0.00	82,429.00	82,429.00	0.00
Colstrip Steam Electric Station, Colstrip, Rosebud	0.00	1.00	0.00	0.00	0.00	5.00	56,776.00	56,783.00	0.00
SMC Nye Mine Site, Nye, Stillwater	1.00	0.00	0.00	0.00	0.00	0.00	35,280.00	35,281.00	0.00
Colstrip Energy L.P. Rosebud Power Plant, Colstrip, Rosebud	0.00	0.00	0.00	0.00	0.00	0.00	15,100.00	15,100.00	0.00
Holcim Trident Plant, Three Forks, Gallatin	0.00	0.00	0.00	0.00	0.00	0.00	14,561.00	14,561.00	0.00
Stillwater Mining Co. East Boulder Ops., Big Timber, Sweet Grass	0.00	0.00	0.00	0.00	0.00	0.00	9,304.00	9,304.00	0.00
Columbia Falls Aluminum Co. L.L.C., Columbia Falls, Flathead	178.00	0.00	0.00	0.00	0.00	0.00	2,244.00	2,422.00	0.00
Lewis & Clark Station, Sidney, Richland	0.00	0.00	0.00	0.00	0.00	0.00	1,994.00	1,994.00	0.00

* The facility ranking is based on the amounts in this column; these quantities exclude non-production-related releases.

VEGETATION APPENDIX

VEGETATION APPENDIX

Habitat Types and Biological Diversity

The land classification system developed by the University of Montana, Montana Gap Analysis Project (MT-GAP), was used to estimate acreages listed for this Appendix (Fisher et al. 1998).

Grasslands

Grasslands cover approximately 7.9 million acres of the 13-county CBNG Planning Area. Of this acreage, 2.6 million acres are underlain by subbituminous or bituminous coal deposits. Grasslands are divided into five types (see Table VEG-1). Species richness data for these types are provided.

Altered herbaceous habitats include grasslands with 30 percent or more cover from introduced species and/or noxious weed species such as thistle (*Cirsium* spp.), cheat grass (*Bromus tectorum*), Japanese brome (*B. japonicus*), spotted knapweed (*Centaurea maculosa*), crested wheatgrass (*Agropyron cristatum*) or yellow sweetclover (*Melilotus officinalis*). Total herbaceous cover ranges from 20 to 80 percent on these sites, which are usually associated with disturbance and can have bare ground coverages in the 10 to 50 percent range (Fisher et al. 1998).

Very Low Cover Grasslands are semi-desert grasslands with total grass cover of 10 to 30 percent. They are dominated by short grasses and forbs such as blue grama (*Bouteloua gracilis*). These grasslands typically have a high amount of bare soil (20 to 60 percent) (Fisher et al. 1998).

Low to Moderate Cover Grasslands are the most abundant grassland type in Montana. They are the category that has the greatest potential for impact from CBM extraction (see Table VEG-1). Total grass coverages on these sites range from 20 to 70 percent and are dominated by short- to medium-height grasses and forbs, such as blue grama, green needlegrass (*Stipa viridula*), Idaho fescue (*Festuca idahoensis*), lupine (*Lupinus* spp.), arrowleaf balsamroot (*Balsamorhiza sagittata*), and bluebunch wheatgrass (*Agropyron spicatum*) (Fisher et al. 1998).

Moderate to High Cover Grasslands are dominated by medium to tall grass species, such as bluebunch wheatgrass, green needlegrass, big bluestem (*Andropogon gerardii*), switchgrass (*Panicum virgatum*), little bluestem (*Andropogon scoparium*), and needle and thread (*Stipa comata*). Grass coverage on these grasslands ranges from 50 to 100 percent (Fisher et al. 1998).

Montane Parklands and Subalpine Meadows are the final type of grasslands classification for Montana lands. Total herbaceous cover in these moist locations can range from 30 to 100 percent and are dominated by species such as beargrass (*Xerophyllum tenax*), several species of sedge (*Carex* spp.), pinegrass (*Calamagrostis rubescens*), arnica (*Arnica* spp.), and subalpine daisy (*Erigeron peregrinus*) (Fisher et al. 1998).

Shrublands

Of the 4.8 million acres designated as shrubland in the CBNG Planning Area, approximately 1.7 million acres are underlain by bituminous coal deposits. Shrublands in Montana are divided into seven categories: Mixed Mesic Shrubs, Mixed Xeric Shrubs, Silver Sage, Salt-Desert Shrubs, Mesic-Grassland Shrubs, Xeric-Grassland Shrubs, and Sagebrush (see Table VEG-2).

Mixed Mesic Shrub sites are characterized by 20 to 100 percent shrub cover. Dominant shrubs on these sites are alder (*Alnus* spp.), ceanothus (*Ceanothus* spp), huckleberry (*Vaccinium* spp.), ninebark (*Physocarpus malvaceus*), snowberry (*Symphoricarpos* spp.), and western serviceberry (*Amelanchier alnifolia*).

Mixed Xeric Shrub sites are characterized by shrub cover ranging from 20 to 50 percent. Dominant shrubs for this type are bitterbrush (*Purshia tridentata*), creeping juniper (*Juniperus horizontalis*), greasewood (*Sarcobatus* spp.), mountain mahogany (*Cercocarpus* spp.), and rabbitbrush (*Chrysothamnus* spp.). Associated grass species cover from 5 to 40 percent of these sites and are predominantly bluebunch wheatgrass, blue grama, Idaho fescue, and western wheatgrass (*Agropyron smithii*).

Silver Sage sites are dominated by silver sage (*Artemisia cana*). This alkali-tolerant species is most abundant in the northeastern part of Montana on moist sites near riparian areas.

Salt-Desert Shrub and Dry Salt Flat sites are dominated by Saltsage (*Atriplex nuttallii*) at 10 to 40 percent cover. These sites are usually underlain by alkali-affected soils in dry, sandy, or saline-seep areas. Species associated with these sites are blue grama, Sandberg's bluegrass (*Poa secunda*), and threadleaf sedge (*Carex filifolia*). It occurs mainly in eastern and southeastern Montana.

Mesic Shrub-Grassland Associations are shrublands with co-dominance between shrubs and grasses that together cover 10 to 50 percent of the site. These are moist, ecotonal areas between shrub-dominated and grass-dominated sites. The grass and shrub species are those found in the respective classes that make up the association.

Xeric Shrub-Grassland Associations are shrublands with a co-dominance of xeric shrubs and grass species in the ecotone between grass- and xeric shrub-dominated sites with the same dominant species as those types. Cover of both shrubs and grasses on these sites range from 10 to 50 percent.

Sagebrush shrubland sites are dominated by big sagebrush (*Artemisia tridentata* spp. *tridentata*, *vaseyana*, and *wyomingensis*) and black sagebrush (*Artemisia nova*) at 20 to 80 percent cover. These are associated with the same grass species listed under the Mixed Xeric Shrub habitat type. Sagebrush shrublands are particularly characteristic of the counties that make up the CBNG Planning Area where more than 33 percent (1.6 million acres) of shrublands fall within this category (Fisher et al. 1998).

Forests

Of the 2.8 million acres classified as forest in the CBNG Planning Area, almost 1.3 million acres are underlain by subbituminous or bituminous coal deposits. The acreages underlain with these coal beds within each forest type in the 13 counties affected by this project are given in Table VEG-3.

Riparian Areas

Riparian areas cover about 1.0 million acres within the CBNG Planning Area. Almost 270,000 acres are underlain by subbituminous or bituminous coal beds.

Table VEG-4 gives the breakdown by type for riparian areas in the project area that are underlain by coal beds. The types with the most acreage are in the Graminoid and Forb and the Shrub categories.

Graminoid and Forb Riparian areas are characterized by herbaceous species at 30 to 100 percent cover and less than 15 percent cover of shrubs and trees. Standing water may be present in areas with cattail marshes. Plant species associated with this type are sedges (*Carex* spp.), cattails (*Typha* spp.), reedgrass (*Calamagrostis* spp.), rushes (*Juncus* spp.), saxifrage (*Saxifraga* spp.), and tufted hairgrass (*Deschampsia caespitosa*).

Shrub Riparian sites are dominated by shrub cover at 20 to 100 percent and tree cover at less than 15 percent. Standing water may be present in willow marshes in this category. Shrub species potentially present on shrub-dominated sites include alder (*Alnus* spp.), black hawthorn (*Crataegus douglasii*), birch (*Betula* spp.), currant (*Ribes* spp.), red-osier dogwood (*Cornus stolonifera*), rose (*Rosa* spp.), shrubby cinquefoil (*Potentilla fruticosa*), snowberry (*Symphoricarpos* spp.), thimbleberry (*Rubus parviflorum*), twinberry (*Lonicera involucrata*), Utah honeysuckle (*Lonicera utahensis*), and willows (*Salix* spp.) (Fisher et al. 1998).

Barren Lands

Table VEG-5 shows that one classification, Badlands, has a significant number of species associated with it.

Additional Tables

Additional Tables within this appendix include Tables VEG-6, VEG-7 and VEG-8; Table VEG-6 shows critically imperiled plant species in the state with potential habitat in the CBNG Planning Area, Table VEG-7 shows noxious weeds found in the state, and Table VEG-8 indicates plant species of special concern by county within the project area.

TABLE VEG-1
GRASSLAND TYPES AND ASSOCIATED WILDLIFE DIVERSITY

Grassland Types	Total Acres In Project Area With Underlying Subbituminous or Bituminous Coal Beds	Distribution	Species Richness*
Altered Herbaceous Habitats	36,969	Found throughout Montana, but most concentrated in the northeastern part of the state.	66
Very Low Cover Grasslands	202,556	Associated with alkaline soils or with disturbance.	68
Low to Moderate Cover Grasslands	2,170,236	Occurs across the state in valleys and foothills and on south aspects in the mountains.	78
Moderate to High Cover Grasslands	141,856	Associated with wet sites primarily in the valleys of central and eastern Montana.	72
Montane Parklands and Subalpine Meadows	7,323	Found at mid- to upper elevations either within forests or above timberline.	62

*Mean number of native terrestrial vertebrates species predicted by habitat type (Fisher et al. 1998). Species richness estimates are simple species counts and not intended to imply that areas with fewer species are not as important as areas with larger numbers of species.

TABLE VEG-2
SHRUBLAND TYPES AND ASSOCIATED DISTRIBUTION AND SPECIES RICHNESS

Shrubland Types	Total Acres In Project Area With Underlying Subbituminous or Bituminous Coal Beds	Distribution	Species Richness*
Mixed Mesic Shrub	175,171	Found in western Montana and in draws or north slopes in eastern Montana	63
Mixed Xeric Shrub	668,043	Occur on dry rocky sites in valleys and low elevation mountain slopes.	75
Silver Sage	3,310	Primarily found in northeastern Montana on moist sites near riparian areas.	61
Salt-Desert Shrub and Dry Salt Flat	45,920	Usually associated with alkaline sites or blowouts in dry, sandy, or saline-seep areas in eastern Montana.	29
Sagebrush	525,753	Occur across the state in valleys and low- to mid-elevational mountain slopes.	74
Mesic Shrub-Grassland Associations	116,813	Found in central and eastern Montana valleys and some low mountain slope areas in moist ecotonal areas between shrub-dominated and grass-dominated sites.	75
Xeric Shrub-Grassland Associations	123,046	Occur primarily in eastern and central Montana valleys and some low mountain slopes on dry sites in valleys, in the ecotone between grass and xeric shrub dominated sites.	85

*Mean number of native terrestrial vertebrates species predicted by habitat type for Montana (Fisher et al. 1998).

TABLE VEG-3
FOREST TYPES IN THE PROJECT AREA UNDERLAIN BY COAL BEDS

Forest Type	Total Acres In Project Area With Underlying Subbituminous or Bituminous Coal Beds	Distribution	Species Richness*
Douglas-fir (*Pseudotsuga menziesii)*	16,726	Occurs across the state, except for the northeastern corner, but primarily found in western and south-central Montana.	77
Douglas-fir with Lodgepole Pine	228	Occurs in western and south-central Montana on mid-upper elevational slopes.	72
Limber Pine *(Pinus flexilis)*	4,838	Dry forest sites at lower elevations in central Montana and at higher elevations on limestone soils in central and eastern Montana.	53
Lodgepole Pine *(Pinus contorta)*	781	Occurs primarily in western and south-central Montana in mountainous regions at cooler, mid-high elevations.	65
Low Density Xeric Forest	303,312	Occurs primarily in eastern Montana on low hills on the edge of grasslands.	83
Mixed Broadleaf Forest	54,241	Occurs across the state, primarily in moist forest areas or near riparian areas or woody draws.	90
Mixed Broadleaf & Conifer Forest	27,761	Occurs across the state, primarily in moist forest areas, near riparian areas or in woody draws.	82
Mixed Subalpine Forest	643	Occurs at mid-high elevations in western and south-central Montana, usually on north, east, and northwest aspects.	67
Mixed Whitebark Pine Forest	10	Occurs in high elevation forest stands at or near tree line in western and south-central Montana.	39
Mixed Xeric Forest	24,910	Occurs at low-mid elevations on dry forest sites in western Montana.	76
Ponderosa Pine	840,850	Occurs across the state, except in northeastern Montana at lower elevations on dry forest sites.	79
Rocky Mountain Juniper *(Juniperus scopulorum)*	3,984	Occurs primarily in central and eastern Montana on dry forest sites.	58
Standing Burnt Forest	2,099	Occurs across the state in forested areas and includes only stands that have burned in the 5 years prior to 1998.	63
Utah Juniper *(Juniperus osteosperma)*	4,953	Occurs primarily in central and eastern Montana on dry forest sites, particularly in Carbon County.	70

*Mean number of native terrestrial vertebrate species predicted by habitat type (Fisher et al. 1998).

TABLE VEG-4
RIPARIAN AREAS IN THE PROJECT AREA UNDERLAIN BY COAL BEDS

Riparian Types	Total Acres In Project Area With Underlying Subbituminous or Bituminous Coal Beds	Distribution	Species Richness*
Conifer	138	Occurs in riparian areas in western and south-central Montana.	114
Broadleaf	36,797	Occurs in riparian areas across Montana.	123
Mixed Broadleaf & Conifer	6,131	Occurs in riparian areas of western and south-central Montana.	134
Graminoid & Forb	114,397	Occurs across the state.	72
Mixed Riparian	30,411	Occurs across the state	104
Shrub	80,233	Occurs across the state.	110

*Mean number of native terrestrial vertebrate species predicted by habitat type (Fisher et al. 1998).

TABLE VEG-5
BARREN LANDS

Barren Lands	Total Acres In Project Area With Underlying Subbituminous or Bituminous Coal Beds	Distribution	Species Richness*
Badlands	208,766	Occurs primarily in central and eastern Montana on sites where bare soil or rock is the dominant cover. Patches of grass or shrubs total less than 10 percent cover. Tree canopy is less than 10 percent on treed sites.	48
Mines, Quarries, Gravel Pits	15,247	Occurs across Montana and are as named.	13
Mixed Barren Sites	48,150	Occurs across the state where live vegetation provides less than 10 percent cover.	17
Rock	24,563	Exposed rock, cliffs, talus slopes, or scree fields across the state.	14

*Mean number of native terrestrial vertebrate species predicted by habitat type (Fisher et al. 1998).

TABLE VEG-6
STATE OF MONTANA CRITICALLY IMPERILED (S1) PLANT SPECIES WITH POTENTIAL HABITAT IN THE CBNG PLANNING AREA

Common Name (Scientific Name)	Habitat
Daggett rock cress (*Arabis demissa var languida*)	Canyon bottoms and outwash plains with dry, stony soils derived from limestone in juniper woodland.
Swamp milkweed (*Asclepias incarnata*)	Wet meadows and thickets.
Ovalleaf milkweed (*Asclepias ovalifolia*)	Open pine woodland in seasonally moist meadow in southeastern Montana.
Narrowleaf milkweed (*Asclepias stenophylla*)	Sandy soils of prairies and open pine woodland in southeastern Montana.
Wind River milkvetch (*Astragalus oreganus*)	Sandy or clayey soil in desert shrublands and sagebrush grassland in the valley zone in south-central Montana.
Small camissonia (*Camissonia parvula*)	Sandy calcareous soils of sagebrush steppe and juniper woodlands in the valleys.
Pregnant sedge (*Carex gravida*)	Open woods, often in ravines with deciduous trees, on the plains of southeastern Montana.
Toothed Scandinavian sedge (*Carex norvegica* ssp. *inserrulata*)	Moist alpine turf.
Birchleaf mountain-mahogany (*Cercocarpus montanus* var. *glaber*)	Open slopes and breaks on the plains of eastern Montana.
Smooth goosefoot (*Chenopodium subglabrum*)	Sparsely vegetated sand dunes and sandy terraces of major rivers on the plains of eastern Montana.
Yellow bee plant (*Cleome lutea*)	Open, often-sandy soil of sagebrush steppe in the valleys.
Miner's candle (*Cryptantha scoparia*)	Sandy soil of sagebrush steppe in the valleys.
Nine-anther dalea (*Dalea enneandra*)	Gravelly grasslands slopes on the plains of eastern Montana.
Silky prairie clover (*Dalea villosa* var. *villosa*)	Loose sand of sand dunes or eroded from sandstone outcrops in eastern Montana.
Scribner's panic grass (*Dichanthelium oligosanthes* var. *scribnerianum*)	Open ponderosa pine woodlands of valleys and plains.
White arctic draba (*Draba fladnizensis*)	Rocky, open soil in the alpine zone.
Porsild's draba (*Draba porsildii*)	Moist, gravelly open soils in the alpine zone.
Entire-leaved avens (*Dryas integrifolia*)	Stony, limestone-derived soil of exposed ridges and plateaus in the alpine zone.

TABLE VEG-6
STATE OF MONTANA CRITICALLY IMPERILED (S1) PLANT SPECIES WITH POTENTIAL HABITAT IN THE CBNG PLANNING AREA

Common Name (Scientific Name)	Habitat
Eaton's daisy (*Erigeron eatonii* ssp. *eatonii*)	Open areas in mountains and foothills.
Beautiful fleabane (*Erigeron formosissimus* var. *viscidus*)	Meadows and forest openings in the montane and subalpine zones.
Smooth buckwheat (*Eriogonum salsuginosum*)	Barren, often bentonitic soil of badlands in the valleys.
Visher's buckwheat (*Eriogonum visheri*)	Barren, often bentonitic badlands slopes and outwashes in the plains.
Sheared cotton-grass (*Eriophorum calllitrix*)	Wet, organic soil of fens and seep areas in alpine tundra.
Hiker's gentian (*Gentianopsis simplex*)	Fens, meadows, and seeps, usually in areas of crystalline parent material, in the montane and subalpine zones.
Hutchinsia (*Hutchinsia procumbens*)	Vernally moist, alkaline soil of sagebrush steppe in the valley to lower montane zones.
Coville's rush (*Juncus covillei* var. *covillei*)	Open, moist to wet, sandy or gravelly soils along valley rivers.
Large-fruited kobresia (*Kobresia macrocarpa*)	Moist tundra, solifluction* slopes, and gravelly lake shores in the alpine zone.
Island koenigia (*Koenigia islandica*)	Wet, open, gravelly soil in seepage areas in the alpine zone.
Lesica's bladderpod (*Lesquerella lesicii*)	Gravelly, limestone-derived soil of open ridges and slopes among Douglas-fir and mountain mahogany woodlands in the montane zone.
Nuttall's desert parsley (*Lomatium nuttallii*)	Dry, rocky slopes of open pine woodland in the plains.
Desert dandelion (*Malacothrix torreyi*)	Dry, sandy sagebrush steppe in the valley and foothill zones.
Bractless mentzelia (*Mentzelia nuda*)	Sandy or gravelly soil of open hills and roadsides on the plains of eastern Montana
Nama (*Nama densum*)	Sandy soil of sagebrush desert in the valleys.
Blue toadflax (*Nuttallanthus texanus*)	Open, sandy or acid shale soils of grasslands and woodlands on the plains of eastern Montana.
Alpine poppy (*Papaver kluanensis*)	Open, rocky slopes with delayed snowmelt in the alpine zone.
Large flowered beardtongue (*Penstemon grandiflorus*)	Sandy soils of valley plains.
Double bladderpod (*Physaria brassicoides*)	Stony or sandy soil of open grassland slopes on the plains in southeastern Montana.
Woolly twinpod (*Physaria didymocarpa* var. *lanata*)	Sandy, often calcareous soil of open grassland or shrubland slopes in the plains.
Slender-branched popcorn-flower (*Plagiobothrys leptocladus*)	Dry mud on the shores of ponds in plains and foothills.

TABLE VEG-6
STATE OF MONTANA CRITICALLY IMPERILED (S1) PLANT SPECIES WITH POTENTIAL HABITAT IN THE CBNG PLANNING AREA

Common Name (Scientific Name)	Habitat
Short-leaved bluegrass (*Poa curta*)	Sparsely vegetated soil of Douglas-fir forest floor in the montane zone.
Low arctic cinquefoil (*Potentilla hyparctica*)	Moist turf in the alpine zone.
Platte cinquefoil (*Potentilla plattensis*)	Grasslands and sagebrush steppe in the valley and montane zones in south-central Montana.
One-flowered cinquefoil (*Potentilla uniflora*)	Open, gravelly slopes and ridgetops in the alpine zone.
Bur oak (*Quercus macrocarpa*)	Low, shale-derived hills on the plains.
Arctic buttercup (*Ranunculus gelidus*)	Moist, open soil on tundra and talus slopes in the alpine zone.
Persistent-sepal yellow-cress (*Rorippa calycina*)	Riverbanks and shorelines in the valleys on the plains on the Missouri and Yellowstone Rivers.
Barratt's willow (*Salix barrattiana*)	Cold, moist soil in the alpine zone.
Yellow marsh saxifrage (*Saxifraga hirculus*)	Wet, organic soil of fen in the alpine zone.
Clasping groundsel (*Senecio amplectens*)	Stony, open soil and talus of slopes in or near the alpine zone.
Shoshonea (*Shoshonea pulvinata*)	Open, exposed limestone outcrops, ridgetops, and canyon rims, in thin rocky soils.
Prairie aster (*Solidago ptarmicoides*)	Open, dry grasslands, often on sandy soil or limestone on the plains of eastern Montana.
Few-flowered goldenrod (*Solidago sparsiflora*)	Sandy soil of grasslands or open woodlands on the plains.
Slender wedgegrass (*Sphenopholis intermedia*)	Wet areas in the valleys or foothills.
Small dropseed (*Sporobolus neglectus*)	Natural and disturbed grasslands.
Fleshy stitchwort (*Stellaria crassifolia*)	Moist or wet meadows, often along streams, in the foothills to alpine zones.
Letterman's needlegrass (*Stipa lettermanii*)	Limestone talus and dry fescue grassland in the valley and foothill zones in southern Montana.
Poison suckleya (*Suckleya suckleyana*)	Playas and disturbed alkaline soils on the plains.
Nannyberry (*Viburnum lentago*)	Openings in riparian forests on the plains.

S1: At high risk because of extremely limited and/or rapidly declining numbers, range, and/or habitat, thus making it highly vulnerable to extirpation in the state.

TABLE VEG-7
STATE OF MONTANA NOXIOUS WEEDS

Common Name	Scientific Name	Category
Hoary cress or White top	*Cardaria draba*	1
Diffuse knapweed	*Centaurea diffusa*	1
Spotted knapweed	*Centaurea maculosa*	1
Russian knapweed	*Centaurea repens*	1
Yellow starthistle	*Centaurea solstitialis*	3
Rush skeletonweed	*Chondrilla juncea*	3
Oxeye daisy	*Chrysanthemum leucanthemum*	1
Canada thistle	*Cirsium arvense*	1
Field bindweed	*Convolvulus arvensis*	1
Common crupina	*Crupina vulgaris*	3
Houndstongue	*Cynoglossum officinale*	1
Leafy spurge	*Euphorbia esula*	1
Orange hawkweed	*Hieracium aurantiacum*	2
Yellow-devil hawkweed	*Hieracium floribundum*	2
Kingdevil hawkweed	*Hieracium piloselloides*	2
Meadow hawkweed	*Hieracium pratense*	2
Common St. Johnswort	*Hypericum perforatum*	1
Yellowflag iris	*Iris pseudacorus*	3
Dyer's woad	*Isatis tinctoria*	2
Perennial pepperweed	*Lepidium latifolium*	2
Dalmatian toadflax	*Linaria dalmatica*	1
Yellow toadflax	*Linaria vulgaris*	1
Purple loosestrife	*Lythrum salicaria*	2
Wandlike loosestrife	*Lythrum virgatum*	2
Eurasian watermilfoil	*Myriophyllum spicatum*	3
Sulfur cinquefoil	*Potentilla recta*	1
Tall buttercup	*Ranunculus acris*	2
Tansy ragwort	*Senecio jacobaea*	2
Tamarisk (Saltcedar)	*Tamarix spp.*	2
Common tansy	*Tanacetum vulgare*	1

Source: The University of Montana – Missoula, Invaders Database System, June 2004.
1 = Noxious weed: currently established and generally widespread in many counties.
2 = Noxious weed: recently introduced and rapidly spreading.
3 = Noxious weeds: not detected in the state or found only in small, scattered, localized infestations.

TABLE VEG-8
PLANT SPECIES OF CONCERN IN THE PLANNING AREA

Common Name	Scientific Name	Known to Occur in the 13 Counties	Additional Information		
			MT	BLM	USFS
Musk-root	*Adoxa moschatellina*	Carbon and Stillwater	S2	S	S
Lead plant	*Amorpha canescens*	Carter and Rosebud	SH	S	
Short-styled columbine	*Aquilegia brevistyla*	Sweet Grass	S2		S
Daggett rock cress	*Arabis demissa var languida*	Carbon	S1	S	
Swamp milkweed	*Asclepias incarnata*	Carbon	S1		
Ovalleaf milkweed	*Asclepias ovalifolia*	Carter	S1		S
Narrowleaf milkweed	*Asclepias stenophylla*	Carter and Rosebud	S1	S	
Sweetwater milkvetch	*Astragalus aretioides*	Big Horn and Carbon	S2	S	
Barr's milkvetch	*Astragalus barrii*	Big Horn, Carter, Powder River, and Rosebud	S2S3	S	S
Geyer's milkvetch	*Astragalus geyeri*	Carbon and Custer	S2	S	
Gray's milkvetch	*Astragalus grayi*	Carbon	S2	S	
Wind River milkvetch	*Astragalus oreganus*	Carbon	S1	S	
Obscure evening-primrose	*Camissonia andina*	Carbon	S2	S	
Small camissonia	*Camissonia parvula*	Carbon	S1	S	
Pregnant sedge	*Carex gravida* var. *gravida*	Big Horn, Powder River, and Rosebud	S1		
Toothed Scandinavian sedge	*Carex norvegica* ssp. *inserrulata*	Carbon and Stillwater	S1		
Birchleaf mountain-mahogany	*Cercocarpus montanus* var. *glaber*	Treasure	S1S2		
Smooth goosefoot	*Chenopodium subglabrum*	Carter, Custer, and Powder River	S1		
Yellow bee plant	*Cleome lutea*	Big Horn and Carbon	S1	S	

TABLE VEG-8
PLANT SPECIES OF CONCERN IN THE PLANNING AREA

			Additional Information		
Common Name	**Scientific Name**	**Known to Occur in the 13 Counties**	**MT**	**BLM**	**USFS**
Miner's candle	*Cryptantha scoparia*	Carbon	S1	S	
Schweinitz' flatsedge	*Cyperus schweinitzii*	Carter, Custer, and Powder River	S2	S	
Small yellow lady's-slipper	*Cypripedium parviflorum*	Stillwater and Sweet Grass	S2S3	S	S
Nine-anther dalea	*Dalea enneandra*	Custer	S1		
Silky prairie clover	*Dalea villosa* var. *villosa*	Carter	S1		
Scribner's panic grass	*Dichanthelium oligosanthes* var. *scribnerianum*	Powder River	S1	S	
White arctic draba	*Draba fladnizensis*	Carbon and Stillwater	S1		
Porsild's draba	*Draba porsildii*	Carbon	S1		
Entire-leaved avens	*Dryas integifolia*	Golden Valley	S1		
Beaked spikerush	*Eleocharis rostellata*	Carbon and Sweet Grass	S2		S
Long sheath waterweed	*Elodea longivaginata*	Stillwater	S2	S	
Giant helleborine	*Epipactis gigantea*	Carbon	S2		S
Eaton's daisy	*Erigeron eatonii* ssp. *eatonii*	Sweet Grass	S1		
Beautiful fleabane	*Erigeron formosissimus* var. *viscidus*	Carbon	S1		
Smooth buckwheat	*Eriogonum salsuginosum*	Carbon	S1	S	
Visher's buckwheat	*Eriogonum visheri*	Carter	S1	S	
Sheathed cotton-grass	*Eriophorum calllitrix*	Carbon	S1		
Hiker's gentian	*Gentianopsis simplex*	Carbon	S1		S

TABLE VEG-8
PLANT SPECIES OF CONCERN IN THE PLANNING AREA

Common Name	Scientific Name	Known to Occur in the 13 Counties	Additional Information MT	BLM	USFS
Northern rattlesnake-plantain	*Goodyera repens*	Wheatland	S2S3		S
Bractless hedge-hyssop	*Gratiola ebracteata*	Yellowstone	S1		
Spiny hopsage	*Grayia spinosa*	Carbon	S2	S	
Beartooth large-flowered goldenweed	*Haplopappus carthamoides* var. *subsquarrosus*	Carbon	S2	S	S
Hutchinsia	*Hutchinsia procumbens*	Carbon	S1	S	
Coville's rush	*Juncus covillei* var. *covillei*	Sweet Grass	S1		
Large-fruited kobresia	*Kobresia macrocarpa*	Carbon	S1		
Island koenigia	*Koenigia islandica*	Carbon	S1		
Leptodactylon	*Leptodactylon caespitosum*	Carbon	S2	S	
Lesica's bladderpod	*Lesquerella lesicii*	Carbon	S1	S	
Nuttall's desert parsley	*Lomatium nuttallii*	Big Horn and Rosebud	S1	S	
Desert dandelion	*Malacothrix torreyi*	Carbon	S1	S	
White-bract stickleaf	*Mentzelia montana*	Custer	SH	S	
Bractless mentzelia	*Mentzelia nuda*	Custer, Powder River, and Rosebud	S1	S	
Dwarf mentzelia	*Mentzelia pumila*	Carbon	S2	S	
Nama	*Nama densum*	Carbon	S1	S	
Blue toadflax	*Nuttallanthus texanus*	Carter	S1		
Alpine poppy	*Papaver kluanensis*	Carbon and Sweet Grass	S1		
Narrowleaf penstemon	*Penstemon angustifolius*	Carter	S2	S	
Large flowered beardtongue	*Penstemon grandiflorus*	Custer	S1		
Plains phlox	*Phlox andicola*	Carter, Powder River, and Rosebud	S2	S	

TABLE VEG-8
PLANT SPECIES OF CONCERN IN THE PLANNING AREA

Common Name	Scientific Name	Known to Occur in the 13 Counties	Additional Information		
			MT	BLM	USFS
Double bladderpod	*Physaria brassicoides*	Carter and Powder River	S2	S	
Woolly twinpod	*Physaria didymocarpa* var. *lanata*	Big Horn and Rosebud	S1	S	
Slender-branched popcorn-flower	*Plagiobothrys leptocladus*	Custer	S1	S	
Short-leaved bluegrass	*Poa curta*	Carbon	S1	S	
Low arctic cinquefoil	*Potentilla hyparctica*	Carbon	S1		
Platte cinquefoil	*Potentilla plattensis*	Carbon	S1	S	
One-flowered cinquefoil	*Potentilla uniflora*	Carbon	S1		
Mealy primrose	*Primula incana*	Carbon	S2	S	S
Bur oak	*Quercus macrocarpa*	Carter	S1	S	
Arctic buttercup	*Ranunculus gelidus*	Stillwater	S1		
Persistent-sepal yellow-cress	*Rorippa calycina*	Big Horn, Custer, Rosebud, Treasure, and Yellowstone	S1	S	
Barratt's willow	*Salix barrattiana*	Carbon	S1		S
Yellow marsh saxifrage	*Saxifraga hirculus*	Carbon	S1		
Clasping groundsel	*Senecio amplectens* var. *holmii*	Carbon	S1		
Shoshonea	*Shoshonea pulvinata*	Carbon	S1	S	S
Prairie aster	*Solidago ptarmicoides*	Carter	S1		
Few-flowered goldenrod	*Solidago sparsiflora*	Stillwater	S1	S	
Slender wedgegrass	*Sphenopholis intermedia*	Big Horn	S1		
Small dropseed	*Sporobolus neglectus*	Wheatland	S1		
Fleshy stitchwort	*Stellaria crassifolia*	Carbon	S1		

TABLE VEG-8
PLANT SPECIES OF CONCERN IN THE PLANNING AREA

Common Name	Scientific Name	Known to Occur in the 13 Counties	Additional Information		
			MT	BLM	USFS
Letterman's needlegrass	*Stipa lettermanii*	Big Horn and Carbon	S1		
Poison suckleya	*Suckleya suckleyana*	Musselshell	S1		
Wyoming sullivantia	*Sullivantia hapemanii*	Big Horn and Carbon	S2	S	
Small-flowered pennycress	*Thlaspi parviflorum*	Carbon	S2	S	
Nannyberry	*Viburnum lentago*	Big Horn	S1		

S = sensitive
S1: At high risk because of extremely limited and/or rapidly declining numbers, range and/or habitat, making it highly vulnerable to extirpation in the state.
S2: At risk because of very limited and/or declining numbers, range and/or habitat, making it vulnerable to extirpation in the state.
S3: At risk because of very limited and/or declining numbers, range and/or habitat, making it vulnerable to extirpation in the state.
SH: Possibly extinct - species known from only historical occurrences, but may nevertheless still be extant; further searching is needed.

WILDLIFE APPENDIX

WILDLIFE APPENDIX

This appendix contains the BLM's letter formally requesting a list of threatened and endangered species from the U.S. Fish and Wildlife Service (USFWS) and initiating consultation for the SEIS/Amendment process under Section 7 of the Endangered Species Act of 1973. The letter from USFWS responding to the BLM's request is included as well.

This appendix also contains a series of tables cited in Chapter 3 of the SEIS/Amendment Wildlife section. Following those tables is the CBNG Programmatic Wildlife Monitoring and Protection Plan developed by the BLM for the Statewide Document and updated for the SEIS/Amendment.

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Parametrix ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

411 108th AVENUE NE, SUITE 1800
BELLEVUE, WA 98004-5571
T. 425 . 458 . 6200 F. 425 . 458 . 6363
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September 15, 2005

R. Mark Wilson
Field Supervisor
USFWS – Ecological Services
100 North Park, Suite 320
Helena, Montana 59601

Re: BLM project notification and request for species

Dear Mr. Wilson:

The Bureau of Land Management (BLM), Miles City Field Office, is preparing a Supplemental Environmental Impact Statement (SEIS) for the Montana Statewide Oil and Gas EIS and Amendment of the Powder River and Billings Resource Management Plans. Parametrix, Inc. is a contractor for this project.

This letter is to request an updated list of threatened and endangered species, pursuant to Section 7 of the Endangered Species Act (ESA), that should be addressed in the Biological Assessment associated with this SEIS. The planning area for SEIS is located in southeastern and south-central Montana, including Powder River, Treasure, Carbon, Golden Valley, Musselshell, Stillwater, Sweet Grass, Wheatland, Yellowstone, and Big Horn counties, as well as portions of Carter, Custer, and Rosebud counties. A figure indicating the SEIS planning area is attached.

If you have any questions, please contact me at 509-996-2402 or jgrialou@parametrix.com.

Thank you,

Julie Grialou
Wildlife Biologist
Parametrix

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United States Department of the Interior
FISH AND WILDLIFE SERVICE

ECOLOGICAL SERVICES
MONTANA FIELD OFFICE
100 N. PARK, SUITE 320
HELENA, MONTANA 59601
PHONE (406) 449-5225, FAX (406) 449-5339

M.02 BLM Coal Bed Methane November 4, 2005

Ms. Julie Grialou
Wildlife Biologist
Parametrix
411 108th Avenue NE, Suite 1800
Bellevue, WA 98004-5571

Dear Ms: Grialou:

This responds to your letter received in the Billings Sub Office on September 23, 2005, requesting an updated species list for the preparation of a Biological Assessment. The Bureau of Land Management (BLM), Miles City Field Office, is preparing a Supplemental Environmental Impact Statement (SEIS) for the Montana Statewide Oil and Gas EIS and Amendment of the Powder River and Billings Resource Management Plans.

The planning area for the SEIS is located in southeastern and south-central Montana, including Treasure, Powder River, Wheatland, Golden Valley, Musselshell, Sweet Grass, Stillwater, Yellowstone, Big Horn, Carbon Counties, as well as portions of Carter, Custer, and Rosebud counties.

In accordance with section 7(c) of the Endangered Species Act of 1973, as amended (Act), my staff has determined that the following threatened or endangered species, or species proposed for listing under the Act, may be present in the project area.

Listed Species	Status	Expected occurrence
Black-footed Ferret (*Mustela nigripes*)	E/XN	Prairie dog complexes; Eastern Montana
Gray Wolf (*Canis lupus*)	T/XN	Forests; Western Montana
Grizzly Bear (*Ursus arctos horribilis*)	T	Alpine/subalpine coniferous forest; western Montana

Canada Lynx (*Lynx canadensis*)	T	Montane spruce/fir forest; western Montana
Whooping Crane (*Grus Americana*)	E	Wetlands, croplands; transient statewide
Least Tern (*Sterna antillarum*)	E	Yellowstone, Missouri River sandbars, beaches; Eastern Montana
Pallid Sturgeon (*Scaphirhynchus albus*)	E	Bottom dwelling; Missouri, Yellowstone Rivers
Bald Eagle (*Haliaeetus leucocephalus*)	T	Forested riparian; statewide

Pursuant to Section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.), the BLM, as the responsible Federal agency, must determine if the proposed actions may affect these listed species and if so, initiate formal consultation with the Fish and Wildlife Service (Service). Guidance for preparation of a biological assessment for the *2002 Montana Statewide Draft Oil and Gas Environmental Impact Statement (EIS) and Amendment of the Powder River and Billings Resource Management Plans* (RMPs), was provided to the BLM by the Service in a letter dated April 2001. Comments on the Draft Oil and Gas Environmental Impact Statement (DEIS) were provided to the BLM's Miles City office in a memorandum dated May 15, 2002.

We also recommend that Parametrix utilize information and data gathered by federal and state agencies that comprise the Powder River Basin Coal Bed Natural Gas Interagency Working Group and Task Groups; and monitoring through the implementation of a *Coal Bed Methane Programmatic Wildlife Monitoring and Protection Plan for the Statewide Oil and Gas Environmental Impact Statement and Amendment of the Powder River and Billings Resource Management Plans* (Wildlife Monitoring Protection Plan) in determining the impacts of the BLM's action on listed and proposed species. The new determination should include possible downstream effects on the pallid sturgeon and least tern.

The Service also advocates that the BLM considers a spatio-temporal based alternative in its analysis of the effects of coal bed methane production on listed and proposed species as outlined in comments made by our biologist involved the DEIS development process. A spatio-temporal alternative would open some area for development and production while leaving other areas free from production until reclamation activities have been completed on earlier phases.

The effects of high-intensity Coal Bed Methane (CBM) development on fish and wildlife resources are largely unknown, but are suspected to reduce the utility of habitat for some species, including listed species and those on the BLM sensitive species list. Species will vary in their

reaction to development, but it will affect how species utilize the landscape. There are currently ongoing studies in Wyoming and Montana that address questions about the effects of CBM development on a variety of species. When these studies are completed, we will have a better foundation on which to base conservation measures in planning this development, until then, it seems prudent to analyze a range of alternatives that includes one based on spatio-temporal phasing as a conservative approach that will have conservation benefits for species for which little in known.

If you have any questions regarding this letter, please contact Lou Hanebury at (406) 247-7367 or Shawn Sartorius at (406) 247-7369 in our Billings Sub Office. We appreciate your efforts to consider endangered species in your project planning.

Sincerely,

R. Mark Wilson

R. Mark Wilson
Field Supervisor
Montana Field Office

cc: USFWS, SO, MT (Attn: Lou Hanebury)
USFWS, FO, WY (Attn: Brad Rogers)
BLM, Miles City Office, MT (Larry Apple)

TABLE WIL-1
WILDLIFE SPECIES OF CONCERN

Common Name	Scientific Name	Occurrence in CBNG Planning Area (by county)[1]	Additional Information			
			MT	BLM	USFS	Suitable Habitat
Mammals						
Pallid bat	*Antrozous pallidus*	All except Wheatland and Sweet Grass	S2	S	S	Arid areas with rocky outcrops, dry forests, riparian forests, and ponderosa pine low slope forests in south-central Montana (UM).
Townsend's big-eared bat	*Corynorhinus (Plecotus) townsendii*	All	S2	S	S	Arid scrub and pine forest, uses caves, snags, old mines and buildings the Custer and Gallatin National Forests (NM).
Spotted bat	*Euderma maculatum*	Golden Valley, Musselshell, Yellowstone, Big Horn, Carbon	S2	S	S	Various habitats in south-central Montana from open coniferous to pastureland.
Northern myotis	*Myotis septentrionalis*	Not known to occur in CBNG planning area, but distribution not well-known.	S2S3	S		Mixed and coniferous forests with small woodland pools and streams, in clearings (NM). Lower Missouri River.
Long-legged myotis[2]	*Myotis volans*	All	S4	S		Forests and woodlands.
Long-eared myotis[2]	*Myotis evotis*	All	S4	S		Forests and woodlands. Also, rocky areas.
Fringed myotis[2]	*Myotis thysanodes*	Wheatland	S3	S		Shrublands, sagebrush-grassland, pine and Douglas-fir forests and woodlands and adjacent riparian forests.
White-tailed prairie dog	*Cynomys leucurus*	Carbon	S1	S	S	Grasslands and plains.
Black-tailed prairie dog	*Cynomys ludovicianus*	All	S3	S	S	Short-grass and mixed-grass prairie in the east of the 110th meridian Fort Belknap Reservation, and Crow Reservation.
North American wolverine	*Gulo gulo luscus*	Wheatland, Sweet Grass, Stillwater, Carbon	S3	S	S	Mature and old-growth fir, pine and larch forests, alpine shrub, talus, and riparian cottonwoods.
Fisher	*Martes pennanti*	Sweet Grass, Stillwater, Carbon	S3	S	S	Forests with mixed habitat, several structural classes, edges and riparian areas.

TABLE WIL-1
WILDLIFE SPECIES OF CONCERN

Common Name	Scientific Name	Occurrence in CBNG Planning Area (by county)[1]	Additional Information: MT	BLM	USFS	Suitable Habitat
Northern bog lemming	*Synaptomys borealis*	Not known to occur in CBNG planning area, but distribution not well-known.	S2		S	Damp pastures, tundra, cool bogs, peatlands, marshes, or moist meadows.
Herptiles						
Boreal/Western toad	*Bufo boreas*	Wheatland, Sweet Grass, Stillwater, Carbon	S2	S	S	Breeding ponds, summer range, and overwinter refugia within lodgepole pine or spruce-fir forests.
Great Plains toad[2]	*Bufo cognatus*	All except Carbon	S2	S		Coulees and sagebrush-grasslands. Breeds in glacial potholes, stock reservoirs, and irrigation ditches.
Plains spadefoot[2]	*Spea bombifrons*	All	S3	S		Sagebrush and grasslands with loose soils, usually near temporary or permanent water.
Wood frog	*Rana sylvatica*	None known in CBNG planning area, but distribution not well-known.		S		Temporary ponds, lakes, and streams with adjacent forests or brush with damp litter.
Northern leopard frog	*Rana pipiens*	All	S3		S	Streams, ponds, lakes, wet prairies, and other bodies of water, frequently moving into grassy, herbaceous fields or forest borders some distance from permanent water.
Snapping turtle	*Chelydra serpentiana*	All except Wheatland, Sweet Grass, Golden Valley, and Musselshell	S3	S		Shallow, mud-bottomed backwaters and ponds with lush aquatic vegetation.
Spiny softshell	*Trionyx spiniferus*	Custer, Rosebud, Big Horn, Treasure, Yellowstone, Musselshell, Golden Valley, Wheatland (Yellowstone River and some tributaries; Musselshell River)	S3	S		Rivers, backwaters, lakes, and ponds with sand or mud areas for digging nests. Missouri and Yellowstone Rivers
Short-horned lizard[2]	*Phrynosoma hernendesi*	All	S3	S		Short-grass prairie and sagebrush areas, especially south-facing slopes, rocky rims of coulees, and shale outcrops.
Milk snake[2]	*Lampropeltis triangulum*	All except Carter, Sweet Grass, Wheatland, and Golden Valley	S2	S	S	Grasslands, sagebrush, and Ponderosa pine savannah. Also, edges of agricultural fields.

TABLE WIL-1
WILDLIFE SPECIES OF CONCERN

Common Name	Scientific Name	Occurrence in CBNG Planning Area (by county)[1]	Additional Information			
			MT	BLM	USFS	Suitable Habitat
Western hog-nosed snake[2]	*Heterodon nasicus*	All	S2	S	S	Arid areas, farmlands, floodplains, grasslands, and sagebrush with well-drained, sandy soils.
Birds						
Common loon[2]	*Gavia immer*	Wheatland, Golden Valley, Sweet Grass, Stillwater, Carbon, Yellowstone, Big Horn	S2B	S	S	Lakes that are at least 13 acres in size and over 5000 feet in elevation. Also, generally require nursery areas that are sheltered, shallow coves with abundant small fish and insects.
Trumpeter swan	*Cygnus buccinator*	Sweet Grass	S2B	S	S	Shallow freshwater marshes, ponds, lakes, and slow-moving rivers with both submerged and emergent vegetation.
Franklin's gull[2]	*Larus pipixcan*	Rosebud, Yellowstone, Carbon, Stillwater, Sweet Grass, Wheatland, Golden Valley, Musselshell	S3B	S		Large, relatively permanent prairie marsh complexes.
White-faced ibis	*Plegadis chihi*	Golden Valley, Musselshell, Stillwater, Yellowstone, Carbon	S1B	S		Freshwater wetlands (marshes, ponds, swamps) with islands of emergent vegetation.
Black tern[2]	*Chlidonias niger*	Carter, Custer, Musselshell, Yellowstone, Stillwater, Sweet Grass, Golden Valley, Wheatland	S3B	S		Breeds in wetlands, marshes, prairie potholes, and small ponds; also, on islands.
Harlequin duck	*Histrionicus histrionicus*	Carbon, Stillwater, Sweet Grass	S2B	S	S	Summer on mountain streams and rivers, nest on the ground near water's edge or in the hollows of dead trees.
Long-billed curlew	*Numenius americanus*	Wheatland, Golden Valley, Musselshell, Sweet Grass, Stillwater, Yellowstone, Big Horn, Carbon	S2B	S	S	Open grasslands and prairies, often near water.
Willet[2]	*Catoptrophorus semipalmatus*	All except Treasure and Custer	S5B	S		Open, dry areas and sandy flats; usually, near lakes or marshes.
Wilson's phalarope[2]	*Phalaropus tricolor*	All except Treasure	S4B	S		Marshy borders of lakes and ponds. Also, flooded fields in spring.

TABLE WIL-1
WILDLIFE SPECIES OF CONCERN

Common Name	Scientific Name	Occurrence in CBNG Planning Area (by county)[1]	Additional Information			
			MT	BLM	USFS	Suitable Habitat
Golden eagle[2]	*Aquila chrysaetos*	All	S4	S		Nests on cliffs and in large trees. Hunts over grasslands, sagebrush, and open woodlands.
Swainson's hawk	*Buteo swainsoni*	All	S3B	S		Shrub-steppe, prairie with scattered trees, or open woodlands.
Ferruginous hawk	*Buteo regalis*	All	S2B	S		Undisturbed plains or shrub-steppe with relatively unbroken terrain and scattered trees, rocks, or treed creek bottoms.
Northern goshawk	*Accipiter gentilis*	All	S3	S	S	Coniferous, deciduous, and mixed forests with a high density of large, old trees and high overstory canopy.
Burrowing owl	*Athene cunicularia*	Rosebud, Wheatland, Golden Valley, Musselshell, Sweet Grass, Stillwater, Yellowstone, Carbon	S2B	S	S	Burrows made by prairie dogs or badgers in rangeland and prairie areas.
Great gray owl	*Strix nebulosa*	Wheatland, Sweet Grass, Stillwater, Carbon	S3	S		Dense, often moist, forests, with openings for hunting.
Three-toed woodpecker	*Picoides tridactylus*	Wheatland, Sweet Grass, Stillwater, Carbon	S3S4	S		Pine-dominated mature forests and burned areas in early successional stages.
Red-headed woodpecker[2]	*Melanerpes erythrocephalus*	All	S3B	S		Riparian forests along major rivers; also, savannahs and large burns.
Black-backed woodpecker	*Picoides articusi*	Custer, Powder River	S2	S	S	Coniferous forests, especially early post-fire habitat
Sprague's pipit[2]	*Anthus spragueii*	All except Big Horn and Powder River	S2B	S	S	Grasslands.
Pygmy nuthatch[2]	*Sitta pygmaea*	All	S4		S	Primarily Ponderosa pine forests. Also, stands of other pines, Douglas-fir, western larch, and aspen.
Blue-gray gnatcatcher	*Polioptila caerulea*	Carbon	S1B	S	S	Juniper and limber pine in the Pryor Mountains of south-central Montana.

TABLE WIL-1
WILDLIFE SPECIES OF CONCERN

Common Name	Scientific Name	Occurrence in CBNG Planning Area (by county)[1]	Additional Information			
			MT	BLM	USFS	Suitable Habitat
Sage thrasher[2]	*Oreoscoptes montanus*	All except Carter	S3B	S		Sagebrush; rocky canyons in arid areas.
Loggerhead shrike	*Lanius ludovicianus*	All	S3B	S	*S*	Edge habitat with open country, thinly wooded or scrubby land with clearings, meadows, and aspen stands bordering dense, ungrazed or lightly grazed grassland.
Sage sparrow	*Amphispiza belli*	Not documented within the past 10 years in CBNG planning area, but range not well-known.	S1S3B	S		Sagebrush.
Baird's sparrow	*Ammodramus bairdii*	All except Treasure, Big Horn, and Musselshell	S2B	S	S	Open tall to mixed grass areas with mixture of mostly native prairie grasses and forbs.
Brewer's sparrow[2]	*Spizella breweri*	All	S2B	S		Sagebrush and grasslands.
Le Conte's sparrow[2]	*Ammodramus leconteii*	Yellowstone, Big Horn	S1S2B	S		Wet or irrigated meadows.
Chestnut-collared longspur[2]	*Calcarius ornatus*	All except Treasure and Big Horn	S3B	S		Short-grass prairie/grasslands.
McCown's longspur[2]	*Calcarius mccownii*	All except Big Horn	S2B	S		Grasslands, pastures, and agricultural areas.
Dickcissel	*Spiza americana*	Powder River, Rosebud, Treasure	S1S2B	S		Hayfields, pastures, weedy fallow fields, and the weedy margins of ditches and roadsides
Fish						
Yellowstone Cutthroat Trout	*Oncorhynchus clarki bouvieri*	Western Counties	S2	S	S	Mountain lakes and streams with varying habitat structures and water velocities.
Blue sucker	*Cycleptus elongatus*	Eastern Counties	S2S3	S		Deep water of large rivers and reservoirs with low turbidity and swift current.

TABLE WIL-1
WILDLIFE SPECIES OF CONCERN

Common Name	Scientific Name	Occurrence in CBNG Planning Area (by county)[1]	Additional Information			
			MT	BLM	USFS	Suitable Habitat
Paddlefish	*Polyodon spathula*	Eastern Counties	S1S2	S		Historically found in calm, open waters of large rivers in the Mississippi River drainage as far north as the Missouri River in Montana.
Pearl dace	*Semotilus/Margariscus margarita*	Unknown within the CBNG Planning Area, but documented in the Yellowstone River just downstream of the CBNG Planning Area (Wibaux and Dawson counties)	S2	S		Cool or cold water lakes, bog ponds, creeks, and springs
Sauger	*Sander canadensis*	All Counties	S2	S		Larger turbid rivers and the muddy shallows of lakes and reservoirs.
Sturgeon chub	*Macrhybopsis gilida*	Eastern Counties	S2	S	S	Turbid water with moderate to strong currents.
Northern redbelly dace X Finescale dace[3]	*Phoxinus eos X Phoxinus neogaeus*	Western Counties	S3	S		Boggy lakes, creeks, and ponds, often with cool, dark, tea-colored water.

[1] Represents updated information (relative to the Statewide Document) on known or expected species' occurrence based on FWP species' range maps (Montana Animal Field Guide, http://fwp.state.mt.us/fieldguide).
[2] Classified as state "S1", BLM sensitive, and/or USFS sensitive after completion of the Statewide Document.
[3] Hybrid, always female.
NI = no information.
S = sensitive.
S1= critically imperiled in the state.
S2 = vulnerable to extinction.
S3 = rare or restricted in range.
S4 = uncommon, but not rare; usually widespread.
S5 = common, widespread, and abundant.
B = breeding status of a migratory species (rank refers to the breeding population of the species in Montana).

TABLE WIL-2
AQUATIC RESOURCES CHARACTERISTICS OF MAJOR DRAINAGES AND REPRESENTATIVE TRIBUTARIES IN THE BILLINGS AND POWDER RIVER RESOURCE MANAGEMENT PLAN AREAS AND IN PARK, GALLATIN, AND BLAINE COUNTIES[1]

Location and Drainage	Length (miles)[2]	Aesthetics[3]	Fisheries Management[4]	Fisheries Resource Value[5]	Number of Fish Species Present	Dewatering Problem Identified?[6]
Billings Resource Management Area						
Yellowstone River West of Billings (River Mile [RM] 360.2 – 554.1)	194	National renown, clean stream and natural setting, stream and area fair			23	
Downstream Section (RM 360.2 – 472.9)	113		Warm/cool water	Outstanding, high, substantial	22	Periodic
Upstream Section (RM 472.9 – 554.1)	81		Trout	Outstanding	14	No
Boulder River (RM 0.0 – 65.2)	65	Natural beauty, pristine	Trout	Outstanding, high, substantial	9	Chronic
Stillwater River (RM 0.0 – 60.0)	60	Natural beauty, clean stream and natural setting	Trout	Outstanding, high, substantial	9	No
Clarks Fork of the Yellowstone						
Downstream Section (RM 0.0 – 41.7)	42	Stream and area fair	Trout	Substantial	18	Periodic
Upstream Section (RM 41.7 – 70.9)	29	Clean stream and natural setting	Trout	Substantial	15	Chronic
Yellowstone River East of Billings (RM 294.5 – 360.2)	66	Clean stream and natural setting, stream and area fair	Warm/cool water and non-trout	High	28	Periodic
Bighorn River						
Downstream Section (RM 0.0 – 42.3)	42	Stream and area fair	Trout	High	30	Periodic
Little Bighorn River (RM 0.0 – 118.5)	119	Natural beauty, clean stream and natural setting	Trout	Moderate	15	No
Upstream Section (RM 42.3 – 84.7)	42	National renown	Trout	Outstanding	20	No
Musselshell River (RM 107.9 – 341.9)	234	Clean stream and natural setting, stream and area fair	Trout	High, substantial	30	Chronic, Periodic
Careless Creek (RM 0.0 – 55.6)	56	Clean stream and natural setting, stream and area fair	Trout	Substantial, moderate, limited	14	Chronic

TABLE WIL-2
AQUATIC RESOURCES CHARACTERISTICS OF MAJOR DRAINAGES AND REPRESENTATIVE TRIBUTARIES IN THE BILLINGS AND POWDER RIVER RESOURCE MANAGEMENT PLAN AREAS AND IN PARK, GALLATIN, AND BLAINE COUNTIES[1]

Location and Drainage	Length (miles)[2]	Aesthetics[3]	Fisheries Management[4]	Fisheries Resource Value[5]	Number of Fish Species Present	Dewatering Problem Identified?[6]
Powder River Resource Management Area						
Yellowstone River (RM 147.0 – 294.5)	140	Clean stream and natural setting	Non-trout	Outstanding, High	47	No
Rosebud Creek (RM 0.0 – 207.6)	208	Stream and area fair	Undesignated	High, substantial	20	No
Tongue River						
Downstream Section (RM 0.0 – 93.3)	93	Clean stream and natural setting, stream and area fair	Trout	High, substantial	37	Chronic, Periodic
Pumpkin Creek (RM 0.0 -171.1)	171	Clean stream and natural setting, stream and area fair	Non-trout	Substantial, moderate, limited	23	No
Upstream Section (RM 93.3 – 217.5)	124	Clean stream and natural setting	Trout	High	30	Periodic
Otter Creek (RM 0.0 – 103.3)	103	Stream and area fair	Undesignated	Substantial, moderate	24	No
Hanging Woman Creek (RM 0.0 – 47.9)	48	Clean stream and natural setting	Undesignated	Substantial, moderate	26	No
Powder River						
Downstream Section (RM 18.4 – 144.5)	126	Low	Non-trout	High	27	Chronic
Mizpah Creek (RM 0.0 – 149.7)	150	Low, clean stream and natural setting	Non-trout	Moderate, limited	19	No
Little Powder River (RM 0.0 – 71.6)	72	Stream and area fair	Non-trout	Substantial	20	No
Upstream Section (RM 144.5 – 220.2)	76	Low, natural and pristine beauty	Non-trout	High	24	Chronic
Little Missouri River (RM 422.4 – 528.4)	103	Clean stream and natural setting	Non-trout	High	19	No

[1]Information derived from the Montana Natural Resource Information System on the Internet at http://nris.state.mt.us/wis/nris1.html (downloaded September 29, 2005). Multiple values for a resource characteristic indicate river reach differences within a given drainage.

[2]Estimated length of drainage within the Resource Management Area or county (based on river miles from NRIS 2005).

[3]Aesthetics ratings in descending order are: national renown; natural and pristine beauty with some development; clean stream and natural setting; stream and area fair; and low (NRIS 2001).

[4]Categories of fisheries management are: trout; non-trout; warm/cool water; and undesignated.

[5]Fisheries resource values ratings in descending order are: outstanding; high; substantial; moderate; and limited.

[6]Dewatering indicates a reduction in streamflow beyond the point where stream habitat is adequate for fish and usually occurs during the irrigation season (July through September). Periodic dewatering indicates a significant problem in drought or water-short years, and chronic dewatering indicates a significant problem in virtually all years.

TABLE WIL-3
COMMON AND SCIENTIFIC NAMES AND RELATIVE ABUNDANCE OF FISH SPECIES PRESENT IN MAJOR DRAINAGES ND REPRESENTATIVE TRIBUTARIES IN THE BILLINGS RESOURCE MANAGEMENT PLAN AREA[1]

Common Name	Scientific Name	Yellowstone River West of Billings	Boulder River	Stillwater River	Clarks Fork of the Yellowstone		Yellowstone River East of Billings	Bighorn River		Little Bighorn River	Musselshell River	Careless Creek
					Downstream Section	Upstream Section		Downstream Section	Upstream Section			
Goldeye	*Hiodon alasoides*	A, C, R			A	U	A	A	A, C, R		C	
Lake chub	*Couesius plumbeus*				R	C	R	R			R	A
Common carp[2]	*Cyprinus carpio*	C, R			R	U	C	C	C	U	C	U
Western silvery/plains minnow	*Hybognathus argyritis/placitus*				R	R		C	R		A, C, R	
Brassy minnow	*Hybognathus hankinsoni*									U	R	U
Emerald shiner	*Notropis atherinoides*	C, R				R	C	R	R		A, C, R	
Sand shiner	*Notropis stramineus*										A, R	
Northern redbelley/finescale dace	*Phoxinus eos/neogaeus*										R	R
Northern redbelly dace	*Phoxinus eos*										R	R
Fathead minnow	*Pimephales promelas*							R		U	C, R	R
Flathead chub	*Platygobio gracilis*	C			U		A, C	C		U	C	A
Longnose dace	*Rhinichthys cataractae*	C, R	C	A, C, R	C	C	A	C	A, C	U		A
River carpsucker	*Carpiodes carpio*	R			C		C	C	R	U		U
Longnose sucker	*Catostomus catostomus*	A, C	A	C, R	A, C	C	C	A	A	C		C
White sucker	*Catostomus commersoni*	C		A, R	A	A	C	A	A	C	A, C, U	A, C
Mountain sucker	*Catostomus platyrhynchus*	A, U, R	C	C, R	C	A	A	C	C	U	C	C
Smallmouth buffalo	*Ictiobus bubalus*	R					R	R			R	
Bigmouth buffalo	*Ictiobus cyprinellus*						R	R				

TABLE WIL-3
COMMON AND SCIENTIFIC NAMES AND RELATIVE ABUNDANCE OF FISH SPECIES PRESENT IN MAJOR DRAINAGES ND REPRESENTATIVE TRIBUTARIES IN THE BILLINGS RESOURCE MANAGEMENT PLAN AREA[1]

Common Name	Scientific Name	Yellowstone River West of Billings	Boulder River	Stillwater River	Clarks Fork of the Yellowstone		Yellowstone River East of Billings	Bighorn River		Little Bighorn River	Musselshell River	Careless Creek
					Downstream Section	Upstream Section		Downstream Section	Upstream Section			
Brook stickleback	*Culaea inconstans*	U										
Shorthead redhorse	*Moxostoma macrolepidotum*	A, C, R			R		A	C	C, R	U	I	C
Black bullhead[2]	*Ameiurus melas*	R						R			R	
Yellow bullhead[2]	*Ameiurus natalis*						U					
Channel catfish	*Ictalurus punctatus*	C, R			R		A	C	R	C	A, C, R	
Stonecat	*Noturus flavus*	R			C		C	R			R	
Northern pike[2]	*Esox lucius*						R	I	R		R	
Yellowstone cutthroat trout	*Oncorhynchus clarki bouvieri*	C, R	R	C	I	C						
Rainbow trout[2]	*Oncorhynchus mykiss*	C	C, R	A, C, R	R	R	U	C	A, C	C	I	
Mountain whitefish	*Prosopium williamsoni*	A, R	A	A, C, R	C	A	U	R	C	C	C, R	
Brown trout[2]	*Salmo trutta*	C, R	A	A, C, R	R	R	U	R	A, C	C	C, R	
Brook trout[2]	*Salvelinus fontinalis*	R	A, R	C, R								C
Arctic grayling	*Thymallus arcticus*					R						
Burbot	*Lota lota*	C, R			C	U	C	C	C, R		I	
Plains killifish	*Fundulus zebrinus*							R				
Mottled sculpin	*Cottus bairdi*	A, C, U	C		R						A, C	
Green sunfish[2]	*Lepomis cyanellus*							R	R		R, I	
Smallmouth bass[2]	*Micropterus dolomieu*						C	R	R	C	C, R	

TABLE WIL-3
COMMON AND SCIENTIFIC NAMES AND RELATIVE ABUNDANCE OF FISH SPECIES PRESENT IN MAJOR DRAINAGES ND REPRESENTATIVE TRIBUTARIES IN THE BILLINGS RESOURCE MANAGEMENT PLAN AREA[1]

					Clarks Fork of the Yellowstone			Bighorn River				
Common Name	**Scientific Name**	**Yellowstone River West of Billings**	**Boulder River**	**Stillwater River**	**Downstream Section**	**Upstream Section**	**Yellowstone River East of Billings**	**Downstream Section**	**Upstream Section**	**Little Bighorn River**	**Musselshell River**	**Careless Creek**
Largemouth bass[2]	*Micropterus salmoides*						R				I	
Black crappie[2]	*Pomoxis nigromaculatus*						I	I			I	
Yellow perch[2]	*Perca flavescens*						R	R				
Sauger	*Stizostedion canadense*	R					R	R	R		C, R	
Walleye[2]	*Stizostedion vitreum*						R	R	R		R	
Freshwater drum	*Aplodinotus grunniens*						R	R			R	

[1]Information derived from the Montana Natural Resource Information System on the Internet at http://nris.state.mt.us/wis/nris1.html (downloaded September 29, 2005). Multiple values for relative abundance indicate variation among river reaches and/or study results within a given drainage. Relative abundance: A = abundant; C = common; U = uncommon; R = rare; I = incidental; P = present.

[2]Indicates species is not native.

TABLE WIL-4
COMMON AND SCIENTIFIC NAMES AND RELATIVE ABUNDANCE OF FISH SPECIES PRESENT IN MAJOR DRAINAGES AND REPRESENTATIVE TRIBUTARIES IN THE POWDER RIVER RESOURCE MANAGEMENT PLAN AREA[1]

Common Name	Scientific Name	Yellowstone River	Rosebud Creek	Tongue River		Pumpkin Creek	Powder River		Little Powder River	Little Missouri River
				Downstream Section	Upstream Section		Downstream Section	Upstream Section		
Pallid sturgeon	*Scaphirhynchus albus*	R					U			
Shovelnose sturgeon	*Scaphirhynchus platorynchus*	A		A			A	A		
Paddlefish	*Polyodon spathula*	C		R						
Goldeye	*Hiodon alasoides*	A	R	A		R	C	C	C	R
Lake chub	*Couesius plumbeus*	R	R			C, R	U	U		C
Common carp[2]	*Cyprinus carpio*	C	C	U	C	C, R	R	R	R	R
Western silvery minnow	*Hybognathus argyritis*	C		U		U		U	U	
Western silvery/plains minnow	*Hybognathus argyritis/placitus*	U		U		C	A	A	A	
Western plains minnow	*Hybognathus placitus*	R		U		U	U	C	R	C
Brassy minnow	*Hybognathus hankinsoni*	R		U		C	R	R	U	
Sturgeon chub	*Macrhybopsis gelida*	U, R		R			C	C		
Spottail shiner	*Notropis hudsonius*	U			U					
Golden shiner[2]	*Notemigonus crysoleucas*	U								C
Emerald shiner	*Notropis atherinoides*	C		U	U					
Sand shiner	*Notropis stramineus*	R		U		C	R	R	A	A
Northern redbelley/finescale dace	*Phoxinus eos/neogaeus*	R								
Fathead minnow	*Pimephales promelas*	C	R	U		A, C	U		A	C
Flathead chub	*Platygobio gracilis*	A	A	A	A	C, R	A	A	R	A
Longnose dace	*Rhinichthys cataractae*	R	C	U	C, R	R	C	C, R	R	C

TABLE WIL-4
COMMON AND SCIENTIFIC NAMES AND RELATIVE ABUNDANCE OF FISH SPECIES PRESENT IN MAJOR DRAINAGES AND REPRESENTATIVE TRIBUTARIES IN THE POWDER RIVER RESOURCE MANAGEMENT PLAN AREA[1]

				Tongue River			Powder River			
Common Name	**Scientific Name**	**Yellowstone River**	**Rosebud Creek**	**Downstream Section**	**Upstream Section**	**Pumpkin Creek**	**Downstream Section**	**Upstream Section**	**Little Powder River**	**Little Missouri River**
Creek chub	*Semotilus atromaculatus*	R		U	R, U	U	R	R	R	C
River carpsucker	*Carpiodes carpio*	C	R	C	C	R	R	R	C	R
Longnose sucker	*Catostomus catostomus*	C	R	C	A, C					
White sucker	*Catostomus commersoni*	C	C	C	A	C, R	U		R	C
Mountain sucker	*Catostomus platyrhynchus*	A, R	R	R	C	R				
Blue sucker	*Cycleptus elongatus*	R		R						
Smallmouth buffalo	*Ictiobus bubalus*	C, R		R	C					
Bigmouth buffalo	*Ictiobus cyprinellus*	C, R		R						
Shorthead redhorse	*Moxostoma macrolepidotum*	A	A	A	A, C	C, R	R	C, R	C	A
Black bullhead[2]	*Ameiurus melas*		R	R	R	R			U	R
Yellow bullhead[2]	*Ameiurus natalis*	R		R	R					
Channel catfish	*Ictalurus punctatus*	A	C	A	C	C, R	C	C, R	C	C
Stonecat	*Noturus flavus*	C	R	C	C	R	R	R	R	U
Northern pike[2]	*Esox lucius*	R	C	U	R					
Rainbow trout[2]	*Oncorhynchus mykiss*	R			R		R	R		
Mountain whitefish	*Prosopium williamsoni*	R			R					
Brown trout[2]	*Salmo trutta*	R			R		R	R		
Brook trout[2]	*Salvelinus fontinalis*		R				R	R		
Burbot	*Lota lota*	C	C	R			R	R		
Plains killifish	*Fundulus zebrinus*						U			R

TABLE WIL-4
COMMON AND SCIENTIFIC NAMES AND RELATIVE ABUNDANCE OF FISH SPECIES PRESENT IN MAJOR DRAINAGES AND REPRESENTATIVE TRIBUTARIES IN THE POWDER RIVER RESOURCE MANAGEMENT PLAN AREA[1]

Common Name	Scientific Name	Yellowstone River	Rosebud Creek	Tongue River		Pumpkin Creek	Powder River		Little Powder River	Little Missouri River
				Downstream Section	Upstream Section		Downstream Section	Upstream Section		
Rock bass[2]	*Ambloplites rupestris*	R		R	C					
Green sunfish[2]	*Lepomis cyanellus*	R			R	R	R	R	R	R
Pumpkinseed[2]	*Lepomis gibbosus*	R, I		R	R	R			U	
Goldfish	*Carassius auratus*				R					
Smallmouth bass[2]	*Micropterus dolomieu*	C, R		C, R	C					
Largemouth bass[2]	*Micropterus salmoides*	R								
White crappie[2]	*Pomoxis annularis*	R	R	U	R	R				
Black crappie[2]	*Pomoxis nigromaculatus*	R, I		U	R					
Yellow perch[2]	*Perca flavescens*	R		I	R					
Sauger	*Stizostedion canadense*	C, R	C	C	C	R	A	A, R		R
Walleye[2]	*Stizostedion vitreum*	C, R	R	C, R	C		R	R		
Freshwater drum	*Aplodinotus grunniens*	R		U						

[1]Information derived from the Montana Natural Resource Information System on the Internet at http://nris.state.mt.us/wis/nris1.html (downloaded September 29, 2005). Multiple values for relative abundance indicate variation among river reaches and/or study results within a given drainage. Relative abundance: A = abundant; C = common; U = uncommon; R = rare; I = incidental; P = present.

[2]Indicates species is not native.

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CBNG Programmatic Wildlife Monitoring and Protection Plan for the Statewide Final Oil and Gas Environmental Impact Statement and Proposed Amendment of the Powder River and Billings Resource Management Plans

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INTRODUCTION

This Wildlife Monitoring and Protection Plan (WMPP) was prepared in conjunction with the Statewide Oil and Gas Draft Environmental Impact Statement (DEIS) (BLM 2001 Montana DEIS) and Amendment of the Powder River and Billings Resource Management Plans (RMPs). The DEIS and Amendment addresses future exploration for and development of Bureau of Land Management (BLM) and state of Montana (state) managed coal bed natural gas (CBNG) resources and conventional oil and gas resources. The planning area excludes those lands administered by the Forest Service, the Crow, Northern Cheyenne, and other Indian lands. The WMPP will be implemented on federal lands, including split estate, in cooperation with state agencies, federal agencies, tribal representatives, Operators, and landowners. If owners and managers of state and private mineral development are willing to incorporate this guidance into management of their CBNG activities, they may become a partner by entering into a Cooperative Agreement.

A variety of planning issues related to wildlife were identified during preparation of the DEIS and DSEIS. The goal of the WMPP is to avoid or minimize impacts to wildlife and serve as a communication tool to foster cooperative relationships among the CBNG and conventional Oil and Gas industry (i.e., Operators), resource management agencies, landowners and adjacent Tribal Governments. Because this plan addresses a large geographic area composed of diverse wildlife habitats and unique situations, it must be programmatic in nature. However, the need to provide management recommendations and guidance to conserve species and habitats remains. Regional or site specific monitoring and protection plans which follow the guidance provided in this programmatic document will be required as part of each CBNG Project Plan. Implementation of this plan during the course of project development and operations should promote wildlife conservation and allow land managers and project personnel to maintain wildlife populations and productivity levels simultaneously with the development of natural oil and gas resources.

PLAN PURPOSE

Oil and gas leasing decisions and lease stipulations were previously analyzed in the Bureau of Land Management (BLM) 1992 *Final Oil and Gas RMP/EIS Amendment* (BLM 1992). Wildlife stipulations attached to leases offer protective measures: 1) for certain species, 2) during a particular time period, or 3) within a specific area. These stipulations may not address other concerns related to special status species or water/habitat related issues caused by direct and indirect impacts from CBNG exploration and development. Because it is purely speculative to predict how all wildlife will react or how development will proceed, it is difficult to develop prescriptive mitigation standards across the entire planning area. Even though BLM has some adaptive management strategies in place (e.g., conditions of approval and compliance inspections), these mechanisms do not give us the information necessary to understand cause and effect relationships across a landscape. Therefore, the purpose of this Plan is to acquire baseline wildlife information, monitor populations, and assess stipulations for effectiveness. The WMPP will facilitate our ability to pinpoint problems (including the evaluation of other contributing factors), design Project Plans which include conservation for declining species, monitor the effectiveness of decisions, and make recommendations to adjust management to address specific situations.

AREA AND OBJECTIVES

The WMPP document is the framework for wildlife monitoring and protection across the Powder River and Billings Resource Management Plan areas (approximately 6.5 million acres) and provides a template for regional and/or project specific WMPP development. The BLM, Montana Fish Wildlife and Parks (MFWP), and United States Fish and Wildlife Service (FWS) will enter into a Cooperative Agreement to work cooperatively to implement portions of the WMPP over the planning area. Specific geographic areas will be delineated as Regional Monitoring Units (RMU). As energy development begins, RMU specific WMPPs, following the same template as this document, will be written in cooperation with other agencies, Operators, landowners and other interests. The objectives of the program are to:

- Establish a framework for cooperation among agencies, Operators, landowners, Tribal Governments and interest groups;
- Provide a process for data collection, data management and reporting ;
- Determine needs for inventory, monitoring and protection measures;
- Provide guidance and recommendations for the conservation of wildlife species;
- Establish protocols for biological clearances of Special Status Species;
- Meet the terms and conditions of the Biological Opinion;
- Determine if management practices to conserve wildlife species and habitat in lease stipulations and conservation measures contained in the BLM

Record of Decision, CBNG Project Plans or Oil and Gas APDs are meeting specified objectives;
- Develop recommendations to adjust management actions based on field observations and monitoring.

Implementation of the WMPP will begin with the issuance of the *Record of Decision* and will remain in effect for the life of the project (approximately 25 years). Guidance for the conservation of special status species will be incorporated into the "Project Plan of Development Preparation Guide." Signatories on an Interagency Cooperative Agreement will serve as the "*Steering Committee.*" A "*Core Team*" (i.e., agency biologists) will oversee the implementation of the programmatic elements of the WMPP. As energy development is initiated in an identified RMU, Wildlife Monitoring Review Teams (i.e., RMU Team) consisting of resource specialists from the BLM, FWS, MFWP and applicable Operator funded biologists will write area-specific monitoring and protection plans. BLM will retain authority for the approval of these plans. Resource specialists may serve as members on more than one RMU project area team. Individual RMU plans may be terminated at the end of any year when there is undeniable evidence illustrating that wildlife populations and productivity have been successfully maintained. The BLM Authorized Officer (AO) would base termination on recommendations from the *RMU Team*.

The programmatic template will undergo a major review for effectiveness every 5 years, or as determined by the *Core Team* and *RMU Team* members. A cooperative agreement among cooperators will be signed on an annual basis to include specific work components of the current year's work.

IMPLEMENTATION PROTOCOL

This section provides preliminary wildlife inventory, monitoring, and protection protocol. Required actions for inventory, monitoring and protection vary by species and development intensity. In areas of development with > 4 well locations per section, additional actions in Table 3 become applicable. Standard protocol for Application for Permit to Drill (APD) and right-of-way (ROW) application field reviews are provided in Table 2. Alternative measures and protocols will be developed as determined by *Core Team* and *RMU Team* members in response to specific needs identified in annual reports. This document provides methods for a number of wildlife species/categories. Additional species/categories may be added based on needs identified in annual wildlife reports. The wildlife species/categories for which specific inventory, monitoring, and protection procedures will be applied were developed based on input provided by the public, other agencies, and the BLM during preparation of the DEIS.

Considerable efforts will be required by agency and operator personnel for plan implementation. Many of the annually proposed agency data collection activities are consistent with current agency activities. Additionally, agency cost-sharing approaches will be considered such that public demands and statutory directives are achieved.

ANNUAL REPORTS AND MEETINGS

State and federal agencies will enter into a master Cooperative Agreement to implement the programmatic elements of inventory, monitoring and protection actions associated with CBNG development in the Powder River and Billings Resource Management Plan areas. A *Core Team* will oversee implementation across the planning area and summarize information from work achieved in various RMUs. Additional cooperative agreements with cooperators will be established as activity is initiated in a RMU.

During project development (i.e., 25 years), Operators will provide an updated inventory and description of all existing project features (i.e., location, size, and associated level of human activity at each feature), as well as those tentatively proposed for development during the next 12 months. Operators should submit the inventory to BLM no later than October 15 of each calendar year. These data will be coupled with annual wildlife inventory, monitoring, and protection data obtained for the previous year and included in annual reports. Annual reports will be prepared by the BLM. Annual wildlife inventory, monitoring, and protection data gathered by parties other than the BLM (e.g., Operators, MFWP) should provide the data to the BLM by October 15 of each calendar year. Upon receipt of these data, annual reports will be completed in draft form by the BLM and submitted to the Operators, USFWS, MFWP, and other interested parties no later than November 15 of each year. A 1-day meeting of the *RMU Teams* and *Core Team* will be organized by the BLM and held in early December of each year to discuss and modify, as necessary, proposed wildlife inventory, monitoring, and protection protocol for the subsequent year. Additional meetings specific to a RMU will be scheduled as necessary.

Discussions regarding annual Operator-specific financing and personnel requirements will be made at these meetings. A formula for determining these requirements will be developed at the first year's meeting (i.e., size of development, anticipated impacts, amount of public land, etc.). A protocol regarding how

to accommodate previously unidentified development sites will also be determined during the annual meeting. Final decisions will be made by the BLM based on the input of all affected parties.

A final annual report will be issued by BLM to all potentially affected individuals and groups by early February of each year. Annual reports will summarize annual wildlife inventory and monitoring results, note any trends across years, identify and assess protection measures implemented during past years, specify monitoring and protection measures proposed for the upcoming year, and recommend modifications to the existing WMPP based on the effectiveness and/or ineffectiveness of past years (i.e., identification of additional species/categories to be monitored). Where possible, data presented in reports will be used to identify potential correlations between development and wildlife productivity and/or abundance. The BLM will be the custodian of the data and stored in BLM's Geographic Information System (GIS) for retrieval, and planning. Annual GIS data updates will be conducted. Raw data collected each year will be provided to other management agencies (e.g., USFWS, MFWP) at the request of these agencies. In addition, sources of potential disturbance to wildlife will be identified, where practical (e.g., development activities, weather conditions, etc.).

Additional reports may be prepared in any year, as necessary, to comply with other relevant wildlife laws, rules, and regulations (e.g., black-footed ferret survey reports, mountain plover and bald eagle habitat loss reports).

ANNUAL INVENTORY AND MONITORING

This document outlines the inventory and monitoring protocol for a number of selected wildlife species/categories. Protocol will be unchanged except as authorized by the BLM or specified in this plan. Additional wildlife species/categories and associated surveys may be added or wildlife species/categories and surveys may be omitted in future years, depending on the results presented in the coordinated review of annual wildlife reports. The MFWP will be contacted during the coordination of survey and other data acquisition phases. Opportunistic wildlife observations may be made throughout the year by agency and Operator personnel.

The frequency of inventory and monitoring will be dependent upon the level of development. In general, inventory and monitoring frequency will increase with increased levels of development. The level of effort should also be determined by species presence and development projection. Inventory and monitoring results may lead to further currently unidentifiable studies (i.e., cause and effect). The following sections identify the level of effort required by the WMPP. Site and species-specific surveys will continue to be conducted in association with APD and ROW application or CBNG project field reviews.

Raptors (Including Bald Eagle and Burrowing Owl)

Raptor inventories will be conducted over the entire CBNG project area every 5 years by BLM and MFWP. In potentially affected areas, baseline inventory should be conducted prior to the commencement of development to determine the location of raptor nests/territories and their activity status by the BLM, with Operator financial assistance. These inventories should be repeated every 5 years (in areas with < 4 well locations/section) thereafter for the Life-of-the-Project (LOP) to monitor trends in habitat use. These surveys may be implemented aerially (e.g., via helicopter) or from the ground. Operators may provide financial assistance for some work. Data collected during the surveys will be recorded on BLM approved data sheets and entered into the BLM GIS database.

Nest productivity monitoring will be conducted by the BLM or a BLM approved biologist. Active nests located within 1 mile of project-related disturbance areas will be monitored between March 1 and mid-July to determine nesting success (i.e., number of nestlings/fledglings per nest). These surveys generally will be conducted from the ground. However, some nests may be difficult to observe from the ground due to steep and rugged topography and may require aerial surveys. Operators may provide financial assistance for aircraft rental as necessary. Attempts will be made to determine the cause of any documented nest failure (e.g., abandonment, predation).

Additional raptor nest activity and productivity monitoring measures will be applied in areas with high levels of development (i.e., areas with greater than or equal to 4 well locations/section) on and within 1 mile of the project area. Inventory/monitoring efforts in these areas, as well as selected undeveloped reference areas will be conducted annually during April and May, followed by nest productivity monitoring. Site and species-specific nest inventories will also continue to be conducted as necessary in association with all APD and ROW application field reviews.

All raptor nest/productivity surveys will be conducted using procedures that minimize potential adverse effects to nesting raptors. Specific survey protocols for reducing detrimental effects are listed in Grier and Fyfe (1987) and Call (1978) and include the following:

- Nest visits will be delayed for as long as possible during the nesting season.
- Nests will be approached cautiously, and their status (i.e., number of nestling/fledglings) will be determined from a distance with binoculars or a spotting scope.
- Nests will be approached tangentially and in an obvious manner to avoid startling adults.
- Nests will not be visited during adverse weather conditions (e.g., extreme cold, precipitation events, windy periods, or during the hottest part of the day).
- Visits will be kept as brief as possible.
- All inventories will be coordinated by the BLM.
- The number of nest visits in any year will be kept to a minimum.

Ferruginous Hawk: Timing of surveys is very important in documenting the territory, occupancy, success and productivity of ferruginous hawk populations. The accepted survey and monitoring guidelines for ferruginous hawk are taken from the *Survey and Monitoring Guidelines for Ferruginous Hawks in Montana, 1995.*

Bald Eagle: Inventory and monitoring protocol for the bald eagle will be as described for raptors, with the following additions. Operators will indicate the presence of eagle habitat as previously defined, on their application. Prior to CBNG development or construction, surveys of the wooded riparian corridors within 1.0 mile of a project area will be conducted in the winter and/or spring by BLM biologists and/or BLM-approved biologists to determine the occurrence of winter bald eagle roosts. Surveys will be conducted from daybreak to 2 hours after sunrise and/or from 2 hours before sunset to 1 hour after sunset by aircraft. Follow-up ground surveys, if necessary, will be conducted during the same time frame. Surveys will be at least 7 days apart. The location, activity, number, and age class (immature, mature) of any bald eagles observed will be recorded. If a roost or suspected roost is identified, BLM, USFWS, and MFWP will be notified and a GPS record of the roost/suspected roost will be obtained and entered into the BLM GIS database. There will be No Surface Occupancy within 0.5 miles of any identified bald eagle roost sites.

Nest productivity will be conducted by the BLM or a BLM-approved biologist in areas with high levels of development (i.e., areas with greater than or equal to four well locations/section) on and within one mile of the project area. Active nests located within one mile of project-related disturbance areas will be monitored between March 1 and mid-July to determine nesting success (i.e., number of nestlings/fledglings per nest).

Burrowing owl: Operators should indicate the presence of prairie dog towns on their application. The presence of sensitive habitat does not necessarily indicate burrowing owls are present. It does, however, alert the company and BLM that a field review and surveys may be required to process the permit or initiate action. In association with APD and ROW application field reviews, prairie dog colonies within 0.5 miles of a proposed project area will be surveyed for western burrowing owls by BLM biologists or a BLM-approved Operator-financed biologist twice yearly from June through August to determine the presence/absence of nesting owls. Efforts will be made to determine reproductive success (no. of fledglings/nest).

Threatened, Endangered, Candidate, and Other Species of Concern

Operators should indicate the presence of cottonwood riparian, herbaceous riparian or wet meadows, permanent water or wetlands, prairie dog towns, or rock outcrops, ridges or knolls on their application. The presence of sensitive habitat may not indicate a species is present. It does, however, alert the company and BLM that a field review and surveys may be required to process the permit or initiate action. The level of effort associated with the inventory and monitoring required for threatened, endangered, candidate, and other species of concern (TEC&SC) will be commensurate with established protocol for the potentially affected species. Methodologies and results of these surveys will be included in annual reports or provided in separate supplemental reports. As TEC&SC species are added to or withdrawn from USFWS and/or BLM lists, appropriate modifications will be incorporated to this plan and specified in annual reports.

TEC&SC data collected during the surveys will be provided only as necessary to those requiring the data for specific management and/or project development needs. Site- and species-specific TEC&SC surveys will continue to be conducted as necessary in association with all APD and ROW application field reviews. Data will be collected on BLM approved data sheets and entered into the BLM GIS database.

Black-footed Ferret

Operators should indicate the presence of prairie dog towns on their application. The presence of sensitive habitat does not necessarily indicate suitable black footed ferret habitat is present. It does, however, alert the company and BLM that a field review and surveys may be required to process the permit or initiate action. BLM biologists and/or BLM-approved Operator-financed biologists will determine the presence/absence of prairie dog colonies within 0.5 miles of proposed activity during APD and ROW application field reviews. Prairie dog colonies on the area will be mapped to determine overall size following the approved methodology. Colony acreage will be determined using GIS applications. Colonies that meet

USFWS size criteria as potential black-footed ferret habitat (USFWS 1989) will be surveyed to determine active burrow density using the methods described by Biggins et al. (1993) or other BLM- and USFWS-approved methodology.

Project activity will be located to avoid impacts to prairie dog colonies that meet USFWS criteria as black-footed ferret habitat (USFWS 1989). If avoidance is not possible, all colonies meeting the USFWS size criteria and any colonies for which density estimates are not obtained will be surveyed for black-footed ferrets by an operator-financed, USFWS-certified surveyor prior to but not more than 1 year in advance of disturbance to these colonies. Black-footed ferret surveys will be conducted in accordance with USFWS guidelines (USFWS 1989) and will be conducted on a site-specific basis, depending on the areas proposed for disturbance in a given year as specified in the annual report. If a black-footed ferret or its sign is found during a survey, all development activity would be subject to recommendations from the *Montana Black-footed Ferret Survey Guidelines*, *Draft Managing Oil and Gas Activities in Prairie Dog Ecosystems with Potential for Black-footed ferret Reintroduction* and re-initiation of Section 7 Consultation with USFWS.

Black-tailed Prairie Dog

The BLM will determine the acreage of occupied and unoccupied (burrows present) black-tailed prairie dog habitat within suitable mountain plover habitat on federally managed surface acres and federal mineral estate lands. Further, a reasonable effort should be made to estimate actual impacts, including habitat loss, CBNG development will have on occupied black-tailed prairie dog acres within suitable mountain plover habitat over the entire project area.

Prairie dog towns on BLM lands within 0.5 miles of a specific project area will be identified, mapped, and surveyed as described in the Black-footed ferret section. In addition, reference prairie dog colonies subject to development will be identified. On an annual basis, the BLM and/or a BLM-approved Operator-financed biologist will survey, at least a portion of, the prairie dog colonies, including the reference colonies. Prairie dog populations are subject to drastic population fluctuations primarily due to disease (plague). Therefore, efforts will be made to compare the data from the reference colonies with that obtained from the project areas, in order to monitor the response of prairie dog populations to CBNG development.

Mountain Plover

Surface use is prohibited within 1/4 mile of active mountain plover nest sites. Disturbance to prairie dog towns will be avoided where possible. Any active prairie dog town occupied by mountain plover will have No Surface Use between April 1 and July 31which may be reduced to No Surface Use within 1/4 mile of an active nest, once nesting has been confirmed. An exception may be granted by the authorized officer, after the BLM consults with the FWS on a case-by-case basis and the operator agrees to adhere to the new operational constraints.

On federally managed surface acres, black-tailed prairie colonies within suitable mountain plover habitat will have a No Surface Occupancy.

Prior to permit approval, habitat suitability will be determined. The BLM, FWS and MFWP will estimate potential mountain plover habitat across the CBNG area using a predictive habitat model. Over the next 5 years, information will be refined by field validation using most current Service mountain plover survey guidelines (USFWS 2002c) to determine the presence/absence of potentially suitable mountain plover habitat. In areas of suitable mountain plover habitat, surveys will be conducted prior to ground disturbance activities by the BLM or a BLM-approved Operator biologist using the USFWS protocol at a specific project area, plus a 0.5 mile buffer. Efforts will be made to identify mountain plover nesting areas not subject to CBNG development, to be used as reference sites. Comparisons will be made of the trends in mountain plover nesting occupancy between these reference areas and areas experiencing CBNG development.

The BLM shall monitor loss of mountain plover habitat associated with all portions of this action (operators will indicate the presence of prairie dog towns or other mountain plover habitat indicators on their application). Suitable mountain plover habitat has been defined under ‘critical habitat’ for the mountain plover in the Statewide Document Biological Opinion. The actual measurement of disturbed habitat can be the responsibility of the BLM, their agent (consultant, contractor, etc) with a written summary provided to the USFWS’ Montana Field Office upon project completion, or immediately if the anticipated impact area is exceeded.

Gray Wolf

According to the *Biological Assessment for Coalbed Methane Production in Montana*, state lands and counties (Gallatin and Park Counties) bordering Yellowstone National Park would be surveyed in the spring for wolves, occupied dens, or scat prior to development. These surveys could be conducted from the air or from the ground. Areas in which wolves are observed would continue to be surveyed annually until reintroduction objectives are met. Efforts will be made to compare production and/or occupancy trends in wolf populations in these areas to a reference population in order to gain more reliable information regarding the response of wolves to CBNG development.

Sage Grouse

BLM and MFWP will conduct sage grouse lek inventories over the entire CBNG project area every 5 years to determine lek locations. Surveys of different areas may occur during different years with the intent that the entire CBNG project area will be covered at least once every 5 years. Existing MFWP Region 7 trend blocks will be monitored annually. There are 4 trend blocks in FWP Region 7; one located in the Decker area and 3 others across the Region. Inventories and protocol will be consistent with the *Montana Sage Grouse Conservation Plan* coordinated by the BLM and MFWP. In areas with any level of development, aerial inventories will be conducted annually on affected sections, two mile buffers, and selected undeveloped reference areas. Reference areas in close proximity to the area currently or proposed for development, would constitute no less than ten leks. These ten leks would be determined by FWP and the BLM. Past monitoring data for these leks should be available. The base level of males for CBNG and reference leks will be determined by FWP and the BLM. The degree of change in these leks will be used as a trigger point and as a base level for adaptive management actions to take place for those leks in and adjacent to CBNG development. For example, if the male sage-grouse population of the ten leks did not change, the expectation would be for the male counts on the CBNG leks to also not change. A negative change in males on the CBNG leks may result in changes in management. Surveys may be conducted aerially or on the ground, as deemed appropriate by the BLM and MFWP. Operator may provide financial assistance.

Aerial surveys will be used for determining lek locations. BLM, MFWP or BLM-approved Operator-financed biologist will monitor sage grouse lek attendance within two miles of CBNG development such that all leks on these areas are surveyed annually. Data collected during these surveys will be recorded on BLM and MFWP approved data sheets and entered into the BLM GIS database. An effort will be made to compare trends of the number of males/lek to reference leks

Sage grouse winter use surveys of suitable winter habitat within 2 miles of a project area will be coordinated by the BLM and implemented by the BLM and/or MFWP during November through February as deemed appropriate by these management agencies, and results will be provided in interim and/or annual reports. These surveys will be conducted to identify sage grouse wintering concentration areas. Historical information of winter sage grouse locations will be useful in focusing efforts in areas suspected of providing winter habitat. Sage grouse winter habitat use surveys will be conducted subsequent to snowfall events to identify crucial winter habitat.

Big Game

Elk, mule deer, white-tailed deer, and pronghorn are the common big game species that occur within parts or all of the CBNG planning area. BLM and MFWP will collect annual big game seasonal habitat use data and make it available to Operators and landowners. Big game use of seasonal habitats is highly dependent upon a combination of environmental factors including forage quality and snow depth. Therefore, it is difficult to attribute changes in habitat use to a single factor. Comparisons in trends between big game seasonal habitat reference areas and seasonal habitats associated with CBNG development may provide some insight into the response of big game to CBNG development.

General Wildlife

Avian mortality observed in pits will be documented, reported to the BLM and USFWS, and measures will be taken to prevent future mortality at the pit(s). Well field access roads and other roads with project-related traffic increases will be monitored for wildlife mortality so that specific mitigation can be designed and implemented as deemed necessary by BLM, in consultation with MFWP.

Aquatic Species

Baseline aquatic inventories will be conducted in potentially affected areas by BLM and MFWP with Operator financial assistance, for 1-2 years prior to development commencing, to determine occurrence, abundance, and population diversity of the aquatic community. These inventories should be repeated every year in selected intermittent/perennial streams associated with produced water discharge as well as selected intermittent/perennial streams associated with no produced water discharge (control sample site).

Natural fluctuations in species occurrence, abundance, and population diversity will be determined by comparing changes in control sample sites to baseline inventories. Changes in occurrence, abundance, and population diversity of the aquatic community in streams associated with produced water discharge may then be possible by comparing to the natural fluctuations.

Detection of a retraction in the range of a species, a downward trend in abundance, or reduced population diversity in systems with produced water discharge shall warrant a review of Project Plans and possible recommendations for adjustment of management to address the specific problems.

Aquatic groups to be inventoried and monitored will include:

-Benthic macroinvertebrates - Determine population diversity using Hess/kick net sampling protocol to measure species abundance and establish a diversity index.

-Amphibians and aquatic reptiles - Determine population diversity and abundance utilizing sampling methodologies being developed for prairie species.

-Non-game fish - Determine population diversity using electrofishing and seining.

-Algae (periphyton) – Determine population diversity.

PROTECTION MEASURES

Wildlife protection measures have been put in place through lease stipulations or terms and conditions from a Biological Opinion from FWS. The following sections describe stipulations or mitigation that restrict activities through lease agreements or terms and conditions to reduce the likelihood of "take" of a federally listed species. For all stipulations and mitigation measures that include protection of specific habitats (e.g., sage-grouse winter habitat), identification of the specific habitat areas will be based on the best available science. This may include BLM surveys or information from other sources. For example, researchers at the University of Montana and Montana State University are developing sage-grouse habitat models that should provide better information on sage-grouse habitat areas than is currently available.

Lease stipulation

The lease stipulations were approved in the 1994 BLM Oil and Gas EIS. These are mandatory measures or actions developed as a result of wildlife research and input from agencies and Operators. Avoidance of important breeding, nesting, and seasonal habitats is the primary protection measure that will reduce the possibility of CBNG and Oil and Gas development having an impact on wildlife populations, productivity, or habitat use. Additional conservation measures will be incorporated through the Project Plan design or as Conditions of Approval. Data collected during monitoring efforts will be used to determine the appropriateness and the effectiveness of these measures throughout the CBNG project area. Based on the results of the monitoring data, these measures will be reviewed by the *Core Team* and *RMU Teams*. As monitoring data are collected over time, it is likely some protection measures will be added, while others will be modified or removed in cooperation with other agencies and the *Core Team*. All changes in these protection measures will be reported, with a justification for the change, in annual reports. A RMP amendment may be required depending on the recommended change.

"Waivers" A lease stipulation may be waived by the Authorized Officer (AO) if a determination is made by the BLM, in consultation with FWS, that the proposed action will not adversely affect the species in question.

"Exceptions" to protection measure may be granted by the AO, in coordination with USFWS for T&E species and MFWP, if the Operator submits a plan that demonstrates impacts from the proposed action will not be significant, or can be adequately mitigated.

"Modifications" may be made by the AO if it is determined portions of the area do not include habitat protected by the stipulation.

Raptors

From March 1 – August 1, all surface disturbing activities are prohibited within ½ mile of active raptor nest sites except ferruginous hawk, bald eagle and peregrine falcon nest sites. For ferruginous hawks and bald eagles, no surface occupancy or use will be allowed within ½ mile of known active nest sites. No surface occupancy or use is allowed within one mile of identified peregrine falcon nests. Active raptor nests are defined as those that have been used within the last two years.

Big Game

Surface use is prohibited to avoid disturbance of white-tailed deer, mule deer, elk, pronghorn antelope, moose, and bighorn sheep during the winter use season, December 1 - March 31. This stipulation does not apply to the operation and maintenance of production facilities.

Elk Parturition Range

In order to protect elk parturition range, surface use is prohibited from April 1 to June 15 within established spring calving range. This protection measure does not apply to the operation and maintenance of production facilities.

Bighorn Sheep – Powder River Breaks

No surface occupancy or use is allowed in the designated Powder River Bighorn Sheep Range. In crucial winter range outside of the designated area, surface use is prohibited from December 1 to March 31.

Sage/Sharptail Grouse

Lek sites
In order to minimize impacts to sharptail and sage grouse leks, surface occupancy within ¼ mile of leks is prohibited. The measure may be waived if the AO, in coordination with MFWP, determines that the entire

leasehold can be occupied without adversely affecting grouse lek sites, or if the lek sites within ¼ mile of the leasehold have not been attended for five consecutive years.

Nesting area
Surface use is prohibited between April 1 – June 30 in grouse nesting habitat within 2 miles of a known lek. This measure does not apply to the operation and maintenance of production facilities. This measure will be implemented to protect sharptail and sage grouse nesting habitat from disturbance during spring and early summer in order to maximize annual production of young, and to minimize disturbance to nesting activities adjacent to nesting sites for the long-term maintenance of grouse populations in the area.

Winter range
Surface use is prohibited from December 1 through March 31 within designated crucial winter range to protect sage grouse from disturbance during winter season use.

Control of West Nile Virus
Manage produced water to reduce the spread of West Nile virus within sage-grouse habitat areas. Implement the following impoundment construction techniques to eliminate water sources that support breeding mosquitoes:

- Overbuild the size of ponds to accommodate a greater volume of water than is discharged. This will result in non-vegetated and muddy shorelines that breeding mosquitoes avoid.
- Build steep shorelines to reduce shallow water and aquatic vegetation around the perimeter of impoundments. Construction of steep shorelines also will increase wave action that deters mosquito production.
- Maintain the water level below rooted vegetation for a muddy shoreline that is unfavorable habitat for mosquito larvae. Rooted vegetation includes both aquatic and upland vegetative types. Always avoid flooding terrestrial vegetation in flat terrain or low lying areas.
- Construct dams or impoundments that restrict down slope seepage or overflow. Seepage and overflow results in down-grade accumulation of vegetated shallow water areas that support breeding mosquitoes.
- Line the channel where discharge water flows into the pond with crushed rock, or use a horizontal pipe to discharge inflow directly into existing open water, thus precluding shallow surface inflow and accumulation of sediment that promotes aquatic vegetation.
- Line the overflow spillway with crushed rock, and construct the spillway with steep sides to preclude the accumulation of shallow water and vegetation.
- Fence pond site to restrict access by livestock and other wild ungulates that trample and disturb shorelines, enrich sediments with manure and create hoof print pockets of water that are attractive to breeding mosquitoes.
- The following measures will also be employed for impoundments storing produced water:
- Use adulticides to target adult mosquito populations and larvicides to control the hatching of mosquito larvae, utilizing only licensed applicators.
- Introduce native fish species, such as fathead minnow or sand shiner, that would feed on mosquito larvae.
- Use electric, solar, or wind-powered fountains or aerators, which would create a ripple disturbance in the water surface and dissuade mosquitoes from laying eggs. This would also have the added effect of aerating the water to support a fish population and help prevent against winter fish die-off.
- Use a vertical discharge pipe in the center of the impoundment to create a ripple effect and aerate the water to support a fish population.

Prairie Dog Towns and Associated Black-footed Ferret Habitat

Prior to surface-disturbing activities, prairie dog colonies and complexes 80 acres or more in size and containing 5 burrows per acre will be examined to determine the presence or absence of black-footed ferrets. The findings of this examination may result in some restrictions to the operator's plans or may even preclude use and occupancy.

The lessee or operator may, at their own option, conduct an examination on the leased lands to determine if black-footed ferrets are present, if the proposed activity would have an adverse effect, or in an effort to block clear an entire area. This examination must be done by, or under the supervision of, a qualified resource specialist approved by the BLM and USFWS certified for black-footed ferret clearances. An acceptable report must be provided documenting the presence or absence of black-footed ferrets and identifying the anticipated effects of the proposed action on the black-footed ferret and its habitat. This stipulation does not apply to the operation and maintenance of production facilities.

Interior Least Tern

The interior least tern is listed as an endangered species under the ESA. Birds occupy sandbars and islands in eastern Montana and along the Yellowstone and Missouri Rivers. Surface occupancy and will be prohibited within 1/4 mile of wetlands identified as interior least tern habitat.

Terms and Conditions from Section 7 Consultation

In order to be exempt from the prohibitions of Section 9 of the Act, the Bureau must comply with the following terms and conditions, which implement the reasonable and prudent measures described and outlined in the Biological Opinion. **These terms and conditions are nondiscretionary.**

All Species

In the event that a bald eagle (dead or injured) or mountain plover (dead or injured) is located during construction and operation, the Service's Billings Sub-Office of the Montana Field Office (406-247-7366) and the Service's Law Enforcement Office (406-247-7355) will be notified within 24 hours. The action agency must provide for monitoring the actual number of individuals taken. Because of difficulty in identification, all small birds found dead should be stored in a freezer for the Service to identify.

- The Bureau shall monitor all loss of bald eagle (nesting, potential nesting and roost sites) and suitable mountain plover habitat associated with all actions covered under the *Montana Statewide Draft Oil and Gas EIS and Amendment of the Powder River and Billings RMPs* and ROD. Bald eagle nesting, potential nesting and roost sites, and suitable mountain plover habitat have been defined under 'habitat use' and critical habitat' respectively, for each species in the Biological Opinion. The actual measurement of disturbed habitat can be the responsibility of the BLM or their agent (consultant, contractor, etc.), with a written summary provided to the Service's Montana Field Office upon project completion. The report will include the location and acres of habitat loss, field survey reports, what stipulations were applied, and a record of any variance granted to timing and/or spatial buffers. The monitoring of habitat loss for these species will commence from the date the Record of Decision (ROD) is signed. The actual measurement of disturbed habitat can be the responsibility of the Bureau's agent (consultant, contractor, etc.) with a written summary provided to the Service's Montana Field Office semi-annually, or immediately if the Bureau determines the action (*i. e.* Application for Permit to Drill (APD), pipeline, compressor station) will adversely affect a listed species. It is the responsibility of the Bureau to ensure the semi-annual reports are complete and filed with the Service in a timely manner. The semi-annual report will include field survey reports for endangered, threatened, proposed and candidate species for all actions covered under the *Montana Statewide Draft Oil and Gas EIS and Amendment of the Powder River and Billings RMPs* and ROD. The semi-annual reports will include all actions completed under this BO up to 30 days prior to the reporting date. The first report will be due 6 months from the signing of the ROD and on the anniversary date of the signing of the ROD. Reporting will continue for the life of the project.
- As outlined in the guidance and conservation measures in the CBNG Programmatic Wildlife Monitoring and Protection Plan for the Statewide Oil and Gas Environmental Impact Statement and Amendment of the Powder River and Billings Resource Management Plans, that "All new roads required for the proposed project will be appropriately constructed, improved, maintained, and signed to minimize potential wildlife/vehicle collisions. Appropriate speed limits will be adhered to on all project area roads, and Operators will advise employees and contractors regarding these speed limits."

Bald Eagle

- The Bureau shall require implementation of all conservation measures/mitigation measures identified in the Biological Assessment prepared for the project and dated April 10, 2002 for the 2003 Final EIS, and wildlife inventory, monitoring, and protection protocol identified in the WMPP. The Bureau shall monitor for compliance with the measures and protocol. These are as follows:
- The appropriate standard seasonal or year-long stipulations for raptors or no surface occupancy for bald eagles as identified in the Billings Resource Management Plan (BLM 1983), Powder River Resource Management Plan (BLM 1984), and Oil and Gas Resource Management Plan/ EIS Amendment (BLM 1992) will be applied. This includes No Surface Occupancy within ½ mile of nests active in the last 7 years and ½ mile of roost sites.
- Inventory and monitoring protocol for the bald eagle will be as described for raptors, with the following additions. Operators will indicate the presence of eagle habitat as previously defined, on their application. Prior to CBNG development or construction, surveys of the wooded riparian corridors within one mile of a project area will be conducted in the winter and/or spring by BLM biologists and/or BLM-approved biologists to determine the occurrence of winter bald eagle roosts. Surveys will be conducted from daybreak to two hours after sunrise and/or from two hours before sunset to one hour after sunset by aircraft. Follow-up ground surveys, if necessary, will be conducted during the same time frame. Surveys will be at least seven days apart. The location, activity, number, and age class (immature, mature) of any bald eagles observed will be recorded and if

a roost or suspected roost is identified, BLM, USFWS, and MFWP will be notified and a GPS record of the roost/suspected roost will be entered into the BLM GIS database. No Surface Occupancy will be applied within 0.5 miles of any identified bald eagle roost sites.

- Nest productivity will be conducted by the BLM or a BLM approved biologist in areas with high levels of development (i.e., areas with greater than or equal to four well locations/section) and within one mile of nest sites. Active nests located within one mile of project-related disturbance areas will be monitored between March 1 and mid-July to determine nesting success (i.e., number of nestlings/fledglings per nest).
- No new above-ground power line should be constructed within the Primary Use Area or within ½ mile of an active eagle nest or nest that has been occupied within the recent past. No surface occupancy or use is allowed within 0.5 miles of known bald eagle nest sites which have been active within the past 7 years. All other actions will be consistent with the *Montana Bald Eagle Management Plan - July 1994*.
- Power lines will be built to standards identified by the Avian Power Line Interaction Committee (1996) to minimize electrocution potential. The Service has more specific recommendations that reaffirm and compliment those presented in the *Suggested Practices*. It should be noted these measures vary in their effectiveness to minimize mortality, and may be modified as they are tested. Local habitat conditions should be considered in their use. The Service does not endorse any specific product that can be used to prevent and/or minimize mortality, however, we are providing a list of *Major Manufacturers of Products to Reduce Animal Interactions on Electrical Utility Facilities*.

New Distribution Lines and Facilities

The following represents raptor protection measures be applied when designing new distribution line construction:

1.1 Bury distribution lines where feasible, and in all areas designated as crucial sage-grouse habitat.
1.2 Raptor-safe structures (e.g., with increased conductor-conductor spacing) are to be used (i.e., minimum 60" for bald eagles would cover all species).
1.3 Equipment installations (overhead service transformers, capacitors, reclosers, etc.) are to be made raptor safe (e.g., by insulating the bushing conductor terminations and by using covered jumper conductors).
1.4 Jumper conductor installations (e.g., corner, tap structures, etc) are to be made raptor safe by using covered jumpers or providing adequate separation.
1.5 Employ covers for arrestors and cutouts.
1.6 To avoid creating perches for raptors near sensitive habitats such as grouse leks, prairie dog towns and wetlands; a ½ mile setback should be used for all distribution lines that have a line-of-sight to the sensitive area. Distribution lines that do not have a line-of-sight position to a sensitive area can be located within ½ mile of the sensitive area. In either case, anti-perching devices should be used to discourage perching to decrease predation and decrease loss of avian predators to electrocution.

Modification of Existing Facilities

Raptor protection measures to be applied when retrofitting existing distribution lines. Problem structures may include dead ends, tap or junction poles, transformers, reclosers and capacitor banks or other structures with less than 60" between conductors or a conductor and ground. The following modifications will be made:

2.1 Cover exposed jumpers.
2.3 Gap any pole top ground wires.
2.4 Isolate grounded guy wires by installing insulating link.
2.5 On transformers, install insulated bushing covers, covered jumpers, cutout covers and arrestor covers.
2.6 When raptor mortalities occur on existing lines and structures, raptor protection measures are to be applied (e.g., modify for raptor-safe construction, install perches, perching deterrents, nesting platforms, nest deterrent devices, etc).
2.7 Use anti-perching devices to discourage perching in sensitive habitats such as grouse leks, prairie dog towns and wetlands to decrease predation, and decrease loss of avian predators to electrocution.
2.8 In areas where midspan collisions are a problem, install effective line-marking devices. All transmission lines that span streams and rivers, should maintain proper spacing and have markers installed.

These additional standards to minimize migratory bird mortalities associated with utility transmission lines, will be incorporated into the Terms and Conditions for all APD's and stipulations for Right-Of-Way applications.

Mountain Plover

- The Bureau shall require implementation of the conservation measures for mountain plover as identified in the Biological Assessment, dated

April 10, 2002, and wildlife inventory, monitoring, and protection protocol addressed in the *WMPP*. The Bureau shall monitor for compliance with the measures and protocol. These are as follows:

- Surface use is prohibited within 1/4 mile of active mountain plover nest sites. Disturbance to prairie dog towns will be avoided where possible. Any active prairie dog town occupied by mountain plovers will have No Surface Use between April 1 and July 31. This area may be reduced to No Surface Use within 1/4 mile of an active nest, once nesting has been confirmed. An exception may be granted by the authorized officer after the BLM consults with the FWS and the operator agrees to adhere to the new operational constraints.
- Due to the declining status of mountain plover in the analysis area and the need to retain the most important and limited nesting habitat, all active prairie dog colonies within suitable mountain plover habitat will have No Surface Occupancy (NSO) stipulations applied. This NSO only applies to federally managed surface. This NSO may be modified through an amendment to this biological opinion after analysis of impacts to this preferred nesting habitat is completed.
- BLM will determine the acreage of occupied black-tailed prairie dog habitat within suitable mountain plover habitat on federally managed surface and mineral estate lands. Further, a reasonable effort should be made to estimate the actual impacts, including habitat loss, CBNG development will have on occupied black-tailed prairie dog acres within suitable mountain plover habitat over the entire project area. The BLM, Service, and cooperators will develop a survey protocol that may include prioritization of subsets of the project area to be analyzed. Based on the results of such analysis, NSO on active prairie dog within suitable mountain plover habitat may be modified utilizing an amendment to the biological opinion.
- Prior to permit approval, habitat suitability will be determined. The BLM, FWS and MFWP will estimate potential mountain plover habitat across the CBNG area using a predictive habitat model. Over the next five years, information will be refined by field validation using most current mountain plover survey guidelines (USFWS 2002c) to determine the presence/absence of potentially suitable mountain plover habitat. In areas of suitable mountain plover habitat, surveys will be conducted prior to ground disturbance activities by the BLM or a BLM-approved biologist using the Service's protocol at a specific project area plus a 0.5 mile buffer. Efforts will be made to identify mountain plover nesting areas not subject to CBNG development as reference sites. Comparisons will be made of the trends in mountain plover nesting occupancy between these reference areas and areas experiencing CBNG development.
- The BLM shall monitor all loss of mountain plover habitat associated with this action (operators will indicate the presence of prairie dog towns or other mountain plover habitat indicators on their application). Suitable mountain plover habitat has been defined under 'critical habitat' for the mountain plover in the Biological Opinion. The actual measurement of disturbed habitat can be the responsibility of the BLM, their agent (consultant, contractor, etc) with a written summary provided to the Service's Montana Field Office upon completion, or immediately if the anticipated impact area is exceeded.
- If suitable mountain plover habitat is present, surveys for nesting mountain plovers will be conducted prior to ground disturbance activities, if ground disturbing activities are anticipated to occur between April 10 and July 10. Disturbance occurring outside this period is permitted, but any loss of mountain plover suitable habitat must be documented. Sites must be surveyed three times between the April 10 and July 10 period, with each survey separated by at least 14 days. The earlier date will facilitate detection of early-breeding plovers. A disturbance-free buffer zone of 1/4 mile will be established around all mountain plover nesting locations between April 1 and July 31. If an active nest is found in the survey area, the planned activity should be delayed 37 days, or seven days post-hatching. If a brood of flightless chicks is observed, activities should be delayed at least seven days (USFWS 2002). Exceptions and/or waiver to stipulations can be made through consultation with the FWS.
- Roads will be located outside of nesting plover habitat where possible. Mitigation measures will be applied to reduce mountain plover mortality caused by increased vehicle traffic. Construct speed bumps, use signing or post speed limits, as necessary to reduce vehicle speeds near occupied mountain plover habitats.
- Creation of hunting perches will be minimized within ½ mile of occupied nesting areas. Utilize perch inhibitors (perch guards) to deter predator use.
- Native seed mixes will be used to re-establish short grass vegetation during reclamation.
- There will be No Surface Occupancy of ancillary facilities (e.g., compressor stations, processing plants) within ½ mile of known nesting areas. Variance may be granted after consultation with the Service.

- In habitat known to be occupied by mountain plover, no dogs will be permitted at work sites to reduce the potential for harassment of plovers.
- The Service will provide operators and the BLM with educational material illustrating and describing the mountain plover, its habitat needs, life history, threats, and development activities that may lead to incidental take of eggs, chicks, or adults. This information will be required to be posted in common areas and circulated in a memorandum among all employees and service providers.

Programmatic Guidance for the Development of Project Plans

Guidance for developing Project Plans and/or conservation measures applied as Conditions of Approval provide a full range of practicable means to avoid or minimize harm to wildlife species or their habitats. Operators will minimize impacts to wildlife by incorporating applicable WMPP programmatic guidance into Project Plans. Not all measures may apply to each site-specific development area and means to reduce harm are not limited to those identified in the WMPP. This guidance may change over time if new Conservation Strategies become available for Special Status Species or monitoring indicates the measure is not effective or unnecessary.

BLM and MFWP will work together through a Cooperative Agreement to collect baseline information about wildlife and sensitive habitats possibly containing special status species. During the project development phase, Operators will identify potentially sensitive habitats and coordinate with BLM to determine which species or habitats are of concern within or adjacent to the project area. In areas where required site-specific wildlife inventories have not been completed, Operators and BLM will work cooperatively to achieve this. BLM's responsibilities under NEPA and the ESA, essentially are the same on split estate as they are with federal surface. BLM and Operators will seek input from the private surface owner to include conservation measures in split estate situations.

The following guidance and conservation measures are considered "features" or project "design criteria" to be used during Project Plan preparation. The design of projects can incorporate conservation needs for wildlife species or measures can be added as "Conditions of Approval." These types of conservation actions offer flexibility for local situations and help minimize or eliminate impacts to the species of interest.

1. Use the best available information for siting structures (e.g., storage facilities, generators and holding tanks) outside of the zone of impact in important wildlife breeding, brood-rearing and winter habitat based on the following considerations.
    a. size of the structure(s),
    b. level/type of anticipated disturbance
    c. life of the operation, and
    d. extent to which impacts would be minimized by topography.
2. Concentrate energy-related facilities when practicable.
3. Encourage development in incremental stages to stagger disturbance; design schedules that include long-term strategies to localize disturbance and recovery within established zones over a staggered time frame.
4. Prioritize areas relative to their need for protection, ranging from complete protection to moderate to high levels of energy development.
5. Develop a comprehensive Project Plan prior to POD or full field development activities to minimize road densities.
6. To reduce additional surface disturbance, existing roads and two-tracks on and adjacent to the CBNG project area will be used to the extent possible and will be upgraded as necessary.
7. Minimize stream channel disturbances and related sediment problems during construction of road and installation of stream crossing structures. Do not place erodible material into stream channels. Remove stockpiled material from high water zones. Locate temporary construction bypass roads in locations where the stream course will have minimal disturbance. Manage time construction activities to protect fisheries and water quality.
8. Design stream-crossings for adequate passage of fish (if potentially exists), minimize impacts on water quality, and at a minimum, the 25-year frequency runoff. Consider oversized pipe when debris loading may pose problems. Ensure sizing provides adequate length to allow for depth of road fill.
9. Use corridors to the maximum extent possible: roads, power, gas and water lines should use the same corridor whenever possible.
10. Avoid, where possible, locating roads in crucial sage grouse breeding, nesting and wintering areas and mountain plover habitats. Develop roads utilizing topography, vegetative cover, site distance, etc. to effectively protect identified wildlife habitats.
11. Conduct all road and stream crossing construction and maintenance activities in accordance with Agency approved mitigation measures and BMPs.

12. Utilize remote monitoring technologies whenever possible to reduce site visits thereby reducing wildlife disturbance and mortalities.
13. All new roads required for the proposed project will be appropriately constructed, improved, maintained, and signed to minimize potential wildlife/vehicle collisions and facilitate wildlife movement through the project area. Appropriate speed limits will be adhered to on all project area roads, and Operators will advise employees and contractors regarding these speed limits.
14. Apply mitigation measures to reduce mountain plover, swift fox or sage-grouse mortality caused by increased vehicle traffic. Construct speed bumps, use signing or post speed limits as necessary to reduce vehicle speeds near sage-grouse leks, mountain plover habitat, or other important wildlife habitats.
15. Road closures may be implemented during crucial periods (e.g., extreme winter conditions, and calving/fawning seasons). Personnel will be advised to minimize stopping and exiting their vehicles in big game winter range when conditions are warranted.
16. Roads no longer required for operations or other uses will be reclaimed if required by the surface owner or surface management agency. Reclamation will be conducted as soon as practical.
17. Operator personnel and contractors will use existing state and county roads and approved access routes, unless an exception is authorized by the surface management agency.
18. Use minimal surface disturbance to install roads and pipelines and reclaim sites of abandoned wells to restore native plant communities.
19. Reclamation of disturbed areas will be initiated as soon as practical. Native species will be used in the reclamation of important wildlife habitat. Livestock forage palatability and wildlife habitat needs will be considered during seed mix formulation.
20. Locate storage facilities, generators, and holding tanks outside the line of sight and sound of important sage-grouse breeding habitat.
21. Minimize ground disturbance in sagebrush stands with documented use by sage-grouse:
    (a) breeding habitat – the lek and associated stands of sagebrush;
    (b) nesting habitat – stands of sagebrush within defined habitats; and
    (c) wintering habitat – designated sagebrush stands with documented winter use by sage-grouse.
22. Site new power lines and pipelines in disturbed areas wherever possible; remove powerlines when use is complete.
23. Bury new power lines in crucial sage grouse or mountain plover habitat. Use the best available information for siting powerlines in important sage-grouse breeding, brood-rearing, and winter habitat.
24. Restrict timing for powerline installation to prevent disturbance during critical sage-grouse periods (breeding April 1 – June 30; winter December 1 –March 31).
25. Encourage monitoring of avian mortalities by entering into a Memorandum of Understanding (MOU) with FWS and the state agencies. The purpose of the MOU is to establish procedures and policies to be employed by the parties to lessen industry's liability concerns about the "take" of migratory birds.
27. Remove unneeded structures and associated infrastructure when project is completed.
28. Restrict maintenance and related activities in sage grouse breeding/nesting complexes; 1 April -30 June, between the hours of 4:00-8:00 am and 7:00-10:00 pm.
29. Restrict noise levels from production facilities to 49 decibels (10 dBa above background noise at the lek).
30. Restrict use of heavy equipment that exceeds 49 dBa within 2 miles of a lek from 4-8am and 7-10pm during April 1 – June 30.
31. Protect, to the extent possible, natural springs from disturbance or degradation.
32. Design and manage produced water storage impoundments so as not to degrade or inundate sage-grouse leks, nesting sites and wintering sites, prairie dog towns or other Special Status Species habitats.
33. CBNG produced water should not be stored in shallow, closed impoundments or playas. Impoundments designed as flow through systems will lessen the likelihood selenium will bioaccumulate to levels adversely affecting other wildlife.
34. Develop offsite mitigation strategies in situations where fragmentation or degradation of Special Status Species habitat is unavoidable.
35. Protect reserve, workover, and production pits potentially hazardous to wildlife by netting and/or fencing as directed by the BLM to prevent wildlife access and minimize the potential for migratory bird mortality.
36. Reduce potential increases in poaching through employee and contractor education regarding wildlife laws. Operator should report violations to BLM and MFWP.

37. Operator employees and their contractors will be discouraged from possessing firearms during working hours.

Measures 3, 4, 20, 21, 24, 25, 29, and 30 were added for the SEIS/Amendment from the Management Plan and Conservation Strategies for sage-grouse in Montana (Montana Sage Grouse Work Group 2005).

Table 1. Summary of General Wildlife Reporting, Inventory, and Monitoring, CBNG Development; Powder River and Billings Resource Management Plans, CBNG Amendment (2002)

Action	Dates	Responsible Entity
Plans of development for outcoming years, showing general location of proposed development	Annually	Team (BLM, USFWS, MFWP, Operators)
Annual reports summarizing findings and presenting necessary protection measures	Annually	BLM with reviews MFWP, USFWS, Operators, and other interested parties
Meeting to finalize future year's inventory, monitoring, and protection measures	Annually	BLM with participation by USFWS, MFWP, Operators, and other interested parties
Inventory and Monitoring		
Big game crucial winter range use monitoring (crucial winter range on the RMU plus 1-mile buffer)	When Applicable	MFWP with BLM assistance
Determine mountain plover habitat suitability	Prior to permit approval	BLM & operator assistance
In areas of suitable mountain plover habitat, conduct nest surveys in project area, plus a .5 mile buffer	Prior to ground disturbing activities	BLM & operator assistance
In areas of suitable mountain plover habitat, map active black-tailed prairie dog colonies on federal surface and federal mineral estate.	Over the next couple years to provide data for an analysis required in the biological opinion.	BLM & operator assistance
Active prairie dog colonies within .5 mile of a specific project area will be identified, mapped and surveyed	Prior to permit approval	BLM with MFWP & operator assistance
Raptor nest inventories (RMU plus 1 mile buffer; burrowing owls excluded)	Every 5 years during April and May	BLM with MFWP & operator assistance
In areas with potential bald eagle winter roost sites, conduct surveys within one mile buffer	Prior to ground disturbing activities	BLM & operator assistance
Conduct bald eagle nest inventories within .5 miles buffer of project area	Between March 1 and mid July	BLM & operator assistance
Monitor productivity at active bald eagle nests within one mile of project-related disturbance	Between March 1 and mid July	BLM & operator assistance
Raptor next productivity monitoring at active nests within one mile of project disturbance area	Every 5 years during March to mid-July	BLM with MFWP & operator assistance
Aerial sage grouse lek inventories (RMU plus two mile buffer)	Every 5 years	BLM with MFWP & operator assistance

Table 1. Summary Of General Wildlife Reporting, Inventory, And Monitoring, CBNG Development; Powder River And Billings Resource Management Plans, CBNG Amendment (2002)(continued)

Action	Dates	Responsible Entity
Inventory and Monitoring (continued)		
Sage grouse lek attendance monitoring on and within 2 miles of the RMU	Annually	BLM with MFWP & operator assistance will visit selected leks each year so that all leks will be visited at least once annually
Threatened, Endangered & Sensitive species inventory/monitoring within selected CBNG development areas and selected undeveloped comparison areas	When Applicable	BLM with MFWP & operator assistance
Native American culturally significant species	When Applicable	BLM, MFWP, Tribal Representatives & Operator Assistance
Other wildlife species inventory/monitoring within selected CBNG development areas and selected undeveloped comparison areas	When Applicable	BLM with MFWP & operator assistance

Table 2. Summary of APD/ROW Survey and Protection Measures, CBNG Development within the Powder River and Billings Resource Management Plans

Protection Measure	Dates
Bald eagle nest surveys within 0.5 mile of project area	Yearlong
Bald eagle nest avoidance within 0.5 mile of active nests	No Surface Use of Occupancy
Bald Eagle Winter Roost surveys within 1 mile of project area	December 1 to April 1
Bald Eagle Winter Roost avoidance within 0.5 miles of roost site	No surface Use or Occupancy
Black-footed ferret surveys	Prairie dog colonies > 80 acres
Mountain plover surveys within 0.5 miles of project area	May 1 to June 15
Active prairie dog colonies on federal surface in mountain plover habitat	BLM & operator assistance
Mountain plover nest/brood avoidance within .25 miles of project area	April 1 to July 31
Peregrine falcon nest avoidance within 1 mile of active nest	No surface use or occupancy
Threatened, Endangered & Sensitive species surveys	As necessary
Threatened, Endangered & Sensitive species avoidance	As necessary
Big game crucial winter range avoidance	December 1 – March 31
Elk Parturition Range avoidance	April 1 – June 15
Big Horn Sheep – Powder River Breaks	No surface use of occupancy
Prairie dog colony mapping and burrow density determinations	Yearlong
Raptor next survey/inventory within 0.5 miles of project area	Yearlong
Raptor nest avoidance within 0.5 miles of active nests	March 1 – August 1
Sage grouse nesting habitat avoidance on areas within 2.0 miles of a lek	April 1 – June 30
Sage grouse and sharptail lek avoidance within 0.25 miles of a lek	No Surface Use or Occupancy
Sharp-tailed grouse nesting habitat avoidance on areas within 0.5 mi. of a lek	March 1 – June 15
Western burrowing owl surveys (prairie dog colonies within 0.5 miles of disturbance)	June – August
General wildlife avoidance/protection	As necessary

Table 3. Additional Wildlife Inventory and Monitoring Measures On and Adjacent to Areas with High Levels of Development (4 Locations/Section), Powder River and Billings Resource Management Plans, CBNG Amendment (2001)

Action	Dates	Responsible Entity
Raptor nest inventory/monitoring on areas with > 4 locations/section plus a 1-mile buffer and selected undeveloped comparison areas.	Annually during April and Mary	BLM surveyor with Operator-provided financial assistance
Raptor productivity monitoring on areas with > 4 locations/section plus a 1-mile buffer and selected undeveloped comparison areas.	Annually during March-July	BLM surveyor with Operator-provided financial assistance for BLM volunteer support
Selected TEC&SC inventory/monitoring on suitable habitats in areas with > 4 locations/section plus a 1-mile buffer and selected undeveloped comparison areas	Annually during spring and summer	BLM or Operator-financed BLM-approved biologist
Collect baseline information for benthic macroinvertebrates, amphibians and aquatic reptiles, algae and non-game fish. Monitor changes on selected streams	Baseline 1 – 2 years prior and annually over the life of the project	BLM surveyor with Operator-provided financial assistance
Sage grouse lek inventory on areas of development plus a 2-mile buffer and selected undeveloped comparison areas.	Annually, March to mid-May	BLM surveyor with Operator-provided financial assistance
Sage grouse lek attendance monitoring on areas of development plus a 2-mile buffer and selected undeveloped comparison areas	Year-long and in any year as deemed necessary by BLM and/or USFWS	Each known lek will be visited at least once annually by the BLM and/or Operator-financed BLM-approved biologist; subsequent visits will occur at BLM-selected leks by the BLM, and/or Operator-financed BLM-approved biologist
Others studies on areas with development and selected undeveloped comparison areas		USFWS and/or BLMA with Operator- and other party-provided financial assistance

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United States Department of the Interior

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http://www.mt.blm.gov/mcfo

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1310 CBMP

November 20, 2006

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

R. Mark Wilson
Field Supervisor
USFWS - Ecological Services
100 North Park, Suite 320
Helena, Montana 59601

Dear Mr. Wilson:

The Bureau of Land Management (BLM), Miles City and Billings Field Offices have prepared the "*Supplement to the Final Montana Statewide Oil and Gas Environmental Impact Statement and Amendment of the Powder River and Billings Resource Management Plans*" (SEIS). The SEIS primarily addresses alternatives for phased coal bed natural gas development in southeastern and south-central Montana. A copy has been enclosed for your review.

Pursuant to BLM's responsibility under Section 7 of the Endangered Species Act of 1973, and in accordance with the Code of Federal Regulations 50 Part 407.12, we are forwarding a copy of the "Biological Assessment for Coal Bed Natural Gas Production in Montana" for your 90-day review.

Shaded areas in the Biological Assessment indicate changes and additions made as a result of supplementing the original EIS. We have found that there would be "no effect" to Canada lynx, gray wolf, grizzly bear, interior least tern and the warm spring zaitzevian riffle beetle. We have also determined a "may effect, but not likely to adversely impact" finding for the Ute ladies-tresses orchid, black-footed ferret, mountain plover, bald eagle, pallid sturgeon and Montana arctic grayling. The black-tailed prairie dog and sage-grouse are discussed but no finding is made as they are not threatened, endangered or candidate species.

Please respond whether or not you concur with the findings of the Biological Assessment. If changes are made between the Draft SEIS and the Final SEIS that would have an effect on threatened or endangered species other than those described in the draft, the BLM will reinitiate consultation with you.

We appreciate the input already provided to us by Shawn Sartorius and look forward to working with you and your staff to complete consultation for this plan.

Please contact Dale Tribby, Assistant Field Manager, Renewable Resources, in the Miles City Field Office at (406) 233-2812 if you have any questions. Thank you for your assistance.

Sincerely,

Theresa M. Hanley

Theresa M. Hanley
Field Manager

2 Enclosures
1-Draft SEIS
2-Biological Assessment

cc: Jay Parks, MT010
Shawn Sartorius, USFWS

BIOLOGICAL ASSESSMENT for

COAL BED Natural Gas PRODUCTION

IN MONTANA

Prepared for

Bureau of Land Management (BLM),
Miles City and
Billings field Offices

October 2006

Julie A. Grialou

Wildlife Biologist

Bob Sullivan

Fisheries Biologist

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BIOLOGICAL ASSESSMENT FOR COAL BED NATURAL GAS PRODUCTION IN MONTANA

1.0 INTRODUCTION

The Bureau of Land Management (BLM), Miles City and Billings Field Offices, Montana, are proposing changes in the coal bed natural gas (CBNG) development program. The Powder River and Billings Resource Management Plans (RMPs), as amended by BLM's 1994 *Oil and Gas Amendment of the Billings, Powder River, and South Dakota Resource Management Plans*, support conventional oil and gas development and limited CBNG exploration and development. The BLM proposes to amend the Billings and Powder River RMPs to address increased interest in CBNG in these RMP areas. An Environmental Impact Statement (EIS) was completed in 2003 to evaluate impacts arising from implementation of the amended RMPs. As a result of lawsuits filed against the BLM's Record of Decision (ROD), the U.S. District Court issued orders, dated February 25, 2005, and April 5, 2005, requiring the BLM to 1) prepare a Supplemental EIS (SEIS) to evaluate a phased development alternative for CBNG production, 2) include the proposed Tongue River Railroad in the cumulative impact analysis, and 3) analyze the effectiveness of water well mitigation agreements. An SEIS/Amendment is being prepared to further evaluate impacts from implementation of the amended RMPs in light of the issues identified by the U.S. District Court.

The oil and gas industry is experiencing growing interest and predicts further interest in the exploration and development of CBNG because of increasing energy demands and efforts to find alternative energy sources. Increased CBNG development would result in a major federal action with potential to significantly affect the environment. This Biological Assessment (BA) was compiled to consider the potential impacts on federally listed and proposed threatened and endangered (T&E) species from proposed changes to levels of CBNG exploration and development in Montana. The BLM is the lead agency for this BA. Designated cooperators—those who have signed a memorandum of understanding with the BLM—are the Environmental Protection Agency (EPA), Department of Energy (DOE), U.S. Army Corps of Engineers (USACE), Bureau of Indian Affairs (BIA), Montana Department of Environmental Quality (MDEQ), Montana Board of Oil and Gas Conservation (MBOGC), Crow Tribe of Montana, Lower Brule Sioux Tribe, and the following counties: Big Horn, Carbon, Golden Valley, Musselshell, Powder River, Rosebud, Treasure, and Yellowstone. The Northern Cheyenne Tribe has also collaborated on the development of this SEIS/Amendment.

This BA is being prepared pursuant to Section 7(c) of the Endangered Species Act (ESA) of 1973, as amended. The U.S. Fish and Wildlife Service (USFWS), as required under the ESA, provided a list of federal endangered, threatened, and proposed threatened and endangered species that may be present in the Planning Area (Table 1 and Appendix A). Eight federally listed threatened, endangered, and proposed for listing wildlife species potentially occur in the Planning Area. The list provided by the USFWS did not include any plant species. Under the ESA, the BLM must ensure that activities instigated under this action do not jeopardize the continued existence of any threatened, endangered, or proposed for listing species. The USFWS must concur that the BLM's actions will not jeopardize a listed species. One candidate species may also potentially be found in the project area. Although not subject to the extensive procedural provisions of the ESA, the USFWS encourages that no action be taken that could impact candidate species and contribute to the need to list the species.

Project Plans of Development (PODs) will be developed and approved using the programmatic guidance outlined in the Preferred Alternative, including the Wildlife Monitoring and Protection Plan (Wildlife Appendix of Draft SEIS/Amendment). Additional monitoring guidance support can be found in the Monitoring, Vegetation, and Mineral Appendices of the Draft SEIS/Amendment. PODs will include baseline inventory in areas where wildlife inventory has not been completed. Operators will be required to submit a Project POD demonstrating how their project design minimizes or mitigates impacts to surface resources and meets objectives for wildlife. Both the Preferred Alternative and the Wildlife Monitoring and Protection Plan involve a cooperative approach, which incorporates adaptive environmental management principles and establishes a framework encouraging industry, landowners, and agencies to work together constructively to incorporate conservation measures into CBNG development. All CBNG development will follow the programmatic guidance to address wildlife concerns, and each individual Project POD will include a site-specific Wildlife Monitoring and Protection Plan which includes mitigation measures specific to species or local habitats. Over the life of the CBNG project, these plans offer some assurances that management will be adapted to address site-specific situations.

TABLE 1
FEDERALLY-LISTED THREATENED, ENDANGERED, AND PROPOSED FOR LISTING SPECIES

Common Name	Scientific Name	Habitat in Montana	Federal Status
Listed Species			
Whooping crane	*Grus americana*	Wetlands, croplands; transient statewide.	E
Bald eagle	*Haliaeetus leucocephalus*	Forested riparian areas throughout the state	T
Interior least tern	*Sterna antillarum athalassos*	Sandbars and islands in eastern Montana and along the Yellowstone and Missouri Rivers.	E
Gray wolf	*Canis lupus*	Adapted to many habitats, need large ungulate prey base and freedom from human influence.	E/XN
Canada lynx	*Felis lynx canadensis*	Montane spruce/fir forest in western Montana.	T
Black-footed ferret	*Mustela nigripes*	Prairie dog complexes in eastern Montana	E/XN
Grizzly bear	*Ursus arctos horribilis*	Alpine/subalpine coniferous forest in western Montana.	T
Pallid sturgeon	*Scaphirhynchus albus*	Bottom dwelling fish of the Missouri and Yellowstone Rivers	E
Candidate Species			
Montana Arctic grayling	*Thymallus arcticus*	Fluvial populations in the cold-water, mountain reaches of the Upper Missouri River, and dispersed streams in SW Montana.	C

T=threatened; E=endangered; E/XN= endangered/non-essential, experimental; C=candidate.

2.0 PROJECT DESCRIPTION

Three action alternatives plus a No Action Alternative and a Preferred Alternative were originally proposed in the 2003 Final EIS (Alternatives A through E). The SEIS/Amendment has proposed two additional action alternatives that consider phased development, as well as a new Preferred Alternative. The Preferred Alternative discussed in this BA was selected based on an analysis of impacts for all alternatives.

Exploration and development of CBNG resources on BLM, state, or fee minerals are allowed subject to agency decisions, lease stipulations, permit requirements, and surface owner agreements. Under the Preferred Alternative, operators would be required to submit a Project POD outlining the proposed federal well development of an area when requesting CBNG well densities greater than 1 well per 640 acres. The Project POD would be developed in consultation with the affected surface owner(s), tribes, other affected parties, and other involved permitting agencies. All shallow coal seams would have vertical wells installed; for deeper coal seams, the operator would drill directionally or demonstrate in the Project POD for agency consideration why directional drilling is not needed or feasible. Operators would develop single or multiple coal seams per their Project PODs; however, there would be only one well bore per coal seam per designated spacing restriction. Operators would also be required to demonstrate in their Project PODs how impacts to surface resources, such as wildlife, would be minimized or mitigated.

Protection of hydrological resources was one of the most critical concerns addressed during the development of the Final EIS and SEIS/Amendment, receiving significant analysis with regards to various options for the management of water produced with CBNG development. In light of those analyses, the Preferred Alternative combines management options so that no degradation of water quality would be allowed in any watershed. The hierarchy for water management options requires beneficial use as the first priority, followed by the operator's choice as outlined in a Water Management Plan, which must be submitted as part of the federal Project POD. A Water Management Plan would be required for exploratory wells, and for each Project POD. Management options available include injection, treatment, impoundment, discharge, or other operator-proposed methods, provided they are addressed in the Water Management Plan and approved by the appropriate agency. Impoundments proposed as part of the Water Management Plan would be designed and located to minimize or mitigate impacts to soil, water, vegetation, and channel stability. No discharge of produced water (treated or untreated) would be allowed into the watershed unless the operator has an approved Montana Pollutant Discharge Elimination System (MPDES) permit and can demonstrate in the Water Management Plan how discharge could occur in accordance with water quality laws without damaging the watershed. The Preferred Alternative also includes a water screen to further protect the quality of water within individual 4th order watersheds. The water screen requires that the cumulative volume of untreated CBNG produced water that could be discharged to surface waters would be limited to 10 percent of the 7Q10 flow. The allowable volume of discharged water would be calculated cumulatively based on permitted outfalls. If the cumulative 10 percent of 7Q10 limit was already used, within a watershed, the proposed discharge from federal APDs would need to be managed by other practices. This limit is based on the amount of discharge allowed under an MPDES permit without exceeding Montana non-degradation criteria.

The air quality objectives for the proposed action include maximizing the number of wells connected to each compressor and requiring natural gas-fired engines for compressors and generators, except in areas with sensitive resources, including people, where noise is an issue. In those areas, the decibel level would be required to be no greater than 50 decibels measured at a distance of one-quarter mile from the compressor. This may require installation of an electrical booster at these locations.

Transportation corridors would be required for utilities, roads, and pipelines with existing disturbances used where possible. The operator will also address in the Project POD how the surface owner was consulted for input into the location of roads, pipelines, and utility line routes. For powerlines, the operator will demonstrate in the Project POD how the proposal for power distribution would mitigate or minimize impacts to affected wildlife. For example, the operator may propose that all or a portion of the powerlines be buried and any aboveground lines be designed following raptor-safe specifications. When wells are abandoned, the associated oil and gas roads would remain open or be

closed at the surface owner's discretion. If the roads where requested to be closed they would be rehabilitated. This includes leaving BLM and state roads open, if access is desirable.

As with current management, there would be no buffer zone for CBNG production around active coal mines (Montana State Office Instruction Memorandum No. 2000-053, June 1, 2000, *No Surface Occupancy Stipulations*).

To help protect wildlife species other than sage-grouse that rely either seasonally or fully on sagebrush habitats (such as mule deer and migratory song birds; i.e. Brewer's sparrow and sage sparrow), the BLM would limit the amount of disturbance in such crucial habitat (e.g., the crucial brood rearing/breeding/wintering habitat) on its administered surface or on private surface overlying federal minerals. Crucial habitat polygons would be identified within each proposed POD during project application development. No more than 20 percent of a crucial habitat polygon would be allowed to be impacted directly over a 20-year period. This would include cumulative direct disturbance of crucial habitats resulting from all activities. Ongoing research and monitoring in the Powder River Basin might cause the BLM to modify the threshold percentage for crucial habitat via adaptive management or mitigation.

To protect sage-grouse, the BLM would place conditions on development within crucial sage-grouse habitat areas. For any development to occur in these crucial habitat areas, there must be a high likelihood that the development will not displace the sage-grouse from the habitat areas. This condition may lead to significantly different development approaches within the crucial sage-grouse habitat areas, which could include low intensity development, widely-spaced well locations, and other options.

For proposed federal CBNG development within 5 miles of the Northern Cheyenne and Crow Indian Reservations, the BLM, in consultation with the tribes, would require site-specific groundwater and air analyses. These analyses would be submitted as part of the operator's POD submissions. The operator's analyses must demonstrate that the overall POD would be protective of Indian Trust, groundwater, CBNG, and air quality. If the analysis indicated that unacceptable levels of impairment to these resources would occur and could not be mitigated in consultation with the tribes, the BLM would not approve the APDs. The BLM might require operator(s) to install groundwater monitoring wells and air monitoring stations between the development area and the reservations to confirm the initial findings of the analyses. Modeling and monitoring groundwater would also provide critical data to determine if CBNG resources were being affected.

This BA addresses environmental impacts from implementation of the Preferred Alternative.

2.1 Project Location

The project is located across south-central and southeastern Montana. This area includes parts of thirteen counties: Carter, Powder River, Custer, Rosebud, Treasure, Wheatland, Sweet Grass, Stillwater, Carbon, Golden Valley, Musselshell, Yellowstone, and Big Horn.

Because of the extensive area covered, Map 1 is provided instead of legal descriptions.

The planning area shown in Map 1 is defined as the area where oil and gas decisions will be made by the BLM. The BLM's planning area is the oil and gas estate administered by the BLM in the Powder River and Billings RMP areas. The planning area excludes those lands administered by the U.S. Department of Agriculture (USDA) Forest Service (USFS), the Crow Tribe, Northern Cheyenne Tribe, and other Indian lands.

For ease of reference, the Billings and Powder River RMP areas are collectively referred to in this document as the BLM CBNG Planning Area. This 13-county area is where there is CBNG development interest.

The Powder River RMP area encompasses the southeastern corner of Montana, including Powder River, Carter, and Treasure counties, and portions of Big Horn, Custer, and Rosebud counties. The Powder River RMP area comprises approximately 1,080,675 acres of federally managed surface and 4,103,700 acres of federal mineral estate.

The Billings RMP area comprises the south-central portion of Montana consisting of Carbon, Golden Valley, Musselshell, Stillwater, Sweet Grass, Wheatland, and Yellowstone counties and the remaining portion of Big Horn County. The Billings RMP area comprises approximately 425,336 acres of federally managed surface and 906,084 acres of federal mineral estate.

Adjacent to the Planning Area, other major land holdings include the Crow and Northern Cheyenne Indian Reservations, the Custer National Forest,

portions of Yellowstone National Park, the Big Horn Canyon National Recreational Area, the Burlington Northern and Santa Fe Railroad, and the Fort Keogh Agricultural Experiment Station. The total surface area of the CBNG Planning Area (all owners) exceeds 21.9 million acres.

2.2 Purpose and Need

The purpose of the project is to provide direction and analysis for CBNG exploration and development on the Powder River and Billings RMP areas.

The oil and gas analysis in current BLM planning documents did not predict as many wells. A BA to establish the impacts to federally listed species is needed to analyze the effects from increased CBNG and oil and gas development.

2.3 Construction Techniques

Each well project has four phases: exploration, development, operation, and shutdown. Once a well is in place, it is expected to operate for 20 years before abandonment. The BA focuses on the first two phases, exploration and development. These lead to the operation phase, once the well is in place.

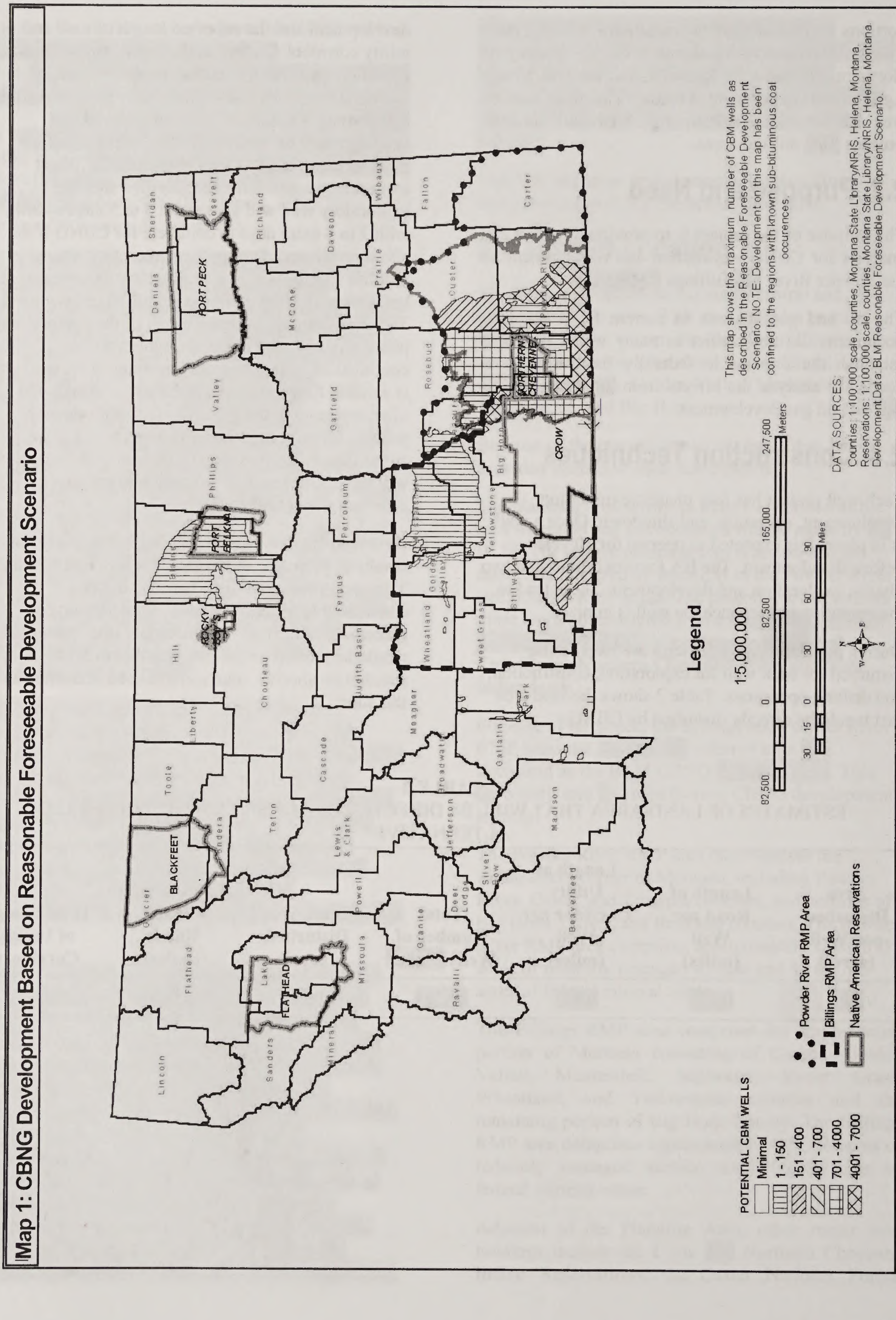
During development, 3.25 acres are likely to be disturbed for each well for exploration, construction, and drilling operations. Table 2 shows the land area that would be directly disturbed by CBNG development and the expected length of road and utility corridors. Under the Preferred Alternative, the use of transportation corridors to consolidate the placement of roads and utilities and minimize surface disturbance is required. It is also required that existing roads be used and utility corridors follow those existing roads if they are available. When exploratory construction begins on a site, the exploratory well will take about 3 to 5 days to drill, with 2 to 3 extra days to complete for CBNG if the site is developed. During the exploratory phase, wildlife species will be disturbed by the presence of bulldozers, drilling equipment, and other machinery. The short-term disturbance effect of the exploratory phase will end with either abandonment or continuation to the development stage if the well site is suitable for production. If the site is abandoned after exploration, the site will take approximately 5 years to attain preconstruction vegetative canopy cover values. Reclamation of the site with vegetation will be undertaken, but restoration to pre-project conditions is not planned.

Development disturbance will begin if exploration results in estimates of suitable levels of production. This and operational disturbance should be considered long-term because of the permanent placement of the pad. The materials source for roads would be located as close as possible to each project site, but no specific sources have been identified at this time.

TABLE 2

ESTIMATES OF LAND AREA THAT WILL BE DIRECTLY DISTURBED BY THE PREFERRED ALTERNATIVE

Area Disturbed per Well (acres)	Length of Road per Well (miles)	Length of Utility Corridor per Well (miles)	Total Number of Wells Drilled	Total Area Disturbed (acres)	Total Length of CBNG Roads (miles)	Total Length of Utility Corridors
3.25	0.237	0.734	18,225	59,045	6,662	20,623


Map 1: CBNG Development Based on Reasonable Foreseeable Development Scenario
POTENTIAL CBM WELLS
Minimal
1 - 150
151 - 400
401 - 700
701 - 4000
4001 - 7000
Powder River RMP Area
Billings RMP Area
Native American Reservations
Legend
1:5,000,000
82,500 0 82,500 165,000 247,500 Meters
30 15 0 30 60 90 Miles
This map shows the maximum number of CBM wells as described in the Reasonable Foreseeable Development Scenario. NOTE: Development on this map has been confined to the regions with known sub-bituminous coal occurences.
DATA SOURCES
Counties: 1:100,000 scale, counties, Montana State Library/NRIS, Helena, Montana
Reservations: 1:100,000 scale, counties, Montana State Library/NRIS, Helena, Montana
Development Data: BLM Reasonable Foreseeable Development Scenario.
Lincoln
Flathead
Glacier
BLACKFEET
Toole
Liberty
Hill
Blaine
ROCKY BOY'S
FORT BELKNAP
Phillips
Valley
Daniels
Sheridan
FORT PECK
Richland
Sanders
Lake
FLATHEAD
Mineral
Missoula
Powell
Teton
Lewis & Clark
Cascade
Chouteau
Judith Basin
Fergus
Petroleum
Garfield
McCone
Dawson
Prairie
Wibaux
Fallon
Carter
Custer
Rosebud
NORTHERN CHEYENNE
Big Horn
CROW
Yellowstone
Golden Valley
Wheatland
Meagher
Broadwater
Jefferson
Granite
Ravalli
Deer Lodge
Silver Bow
Beaverhead
Madison
Gallatin
Park
Stillwater
Sweet Grass

3.0 DATA COLLECTION AND ASSESSMENT

Appropriate federal and state agencies were contacted to obtain information on specific habitats and areas within the project area where listed species may potentially occur. Research literature was reviewed for listed species. Biologists with knowledge of the area were interviewed before assessing impacts that could result from project implementation. Impacts would be considered significant if implementation of the Preferred Alternative would adversely affect any listed or proposed species, including destruction of occupied habitat or "taking" (harm, harassment, pursuit, injury, or kill) of federally listed wildlife or plant species.

3.1 Literature Studies

A literature search was conducted to determine habitat requirements for each listed species. Habitat requirements for listed species were then compared to terrestrial vegetation communities in the project area to determine the potential for occurrence of listed species. If suitable habitat was present, a literature search was completed to determine if existing site-specific or regional data on the species were available. The broad geographic area covered by this BA means that every species listed has some potential habitat within the proposed project's boundary.

3.2 Survey Methodologies

No specific surveys were conducted for this BA. Therefore, it is essential that clearance surveys be conducted on a site-by-site basis before CBNG exploration begins. Site clearances and field survey methodologies differ according to the species of interest.

3.2.2 MAMMALS

Four threatened, endangered, or proposed mammalian species potentially occur in the project area (Table 1). Two of the species, the black-footed ferret and gray wolf, are listed as experimental populations for specific regions within the state of Montana. Specific surveys need not be conducted for the gray wolf or the Canada lynx because of the unlikely possibility of actually observing these species even if they are present. Instead, reconnaissance-level surveys for signs of these species (scat and tracks) will be included with other biological surveys at individual project sites. In addition, in habitats with higher potential for these animals, specific transects will be put in place and checked for scat. If found, hair and track traps for lynx and grizzly bears will be used to determine positive presence. If wolves are suspected, taped howling reconnaissance surveys will be employed to ascertain whether these species are using the area for denning.

3.2.3 BIRDS

One threatened and two endangered bird species are known to or could occur in the project area. Specific surveys would include nesting surveys and winter foraging surveys. Consultation with local wildlife biologists will precede all exploratory CBNG activities within 1.6 miles of any waterway. This consultation will result in obtaining nesting and winter foraging information for bald eagles that may be impacted by CBNG activities. If nesting sites are known to occur within this radius of the proposed CBNG site or sites, a biologist will be retained to survey specifically for this species for the duration of both the exploration and development phases in that locale. If the proposed CBNG site is found to be within a nesting or winter foraging area, CBNG work will be halted until the nest is no longer active or until winter has passed and the foraging eagles have migrated. BLM leasing stipulations pertaining to bald eagles apply and will be implemented.

Interior least terns are colonial nesting waterbirds that seldom swim, spending much of their time on the wing (Hubbard 1978). Therefore, clearance surveys that search for flying birds or nesting colonies will be done in appropriate habitats, sand bar river areas, or nearby sand pits, in the spring by a qualified biologist prior to exploration and well development.

Because whooping cranes are rare migrants in the planning area vicinity and do not nest or winter in the area, surveys for these birds will not be conducted.

4.0 PROJECT CONDITIONS

This section discusses habitat requirements and distributions of species listed or proposed for listing by the USFWS as endangered or threatened, the status of the species or habitat within the project area, potential impacts from project implementation, conservation actions, and an impact determination. Habitat requirements and distribution data were obtained from Federal Register (FR) listing notices, conversations with federal and state biologists, and other published and unpublished research data.

4.1 Mammals

4.1.1 BLACK-FOOTED FERRET (*MUSTELA NIGRIPES*)

4.1.1.1 Habitat

This species was listed as endangered March 11, 1967, and is currently listed as endangered/experimental, non-essential in Montana. Historically, black-footed ferrets inhabited grassland plains (shortgrass and midgrass prairies) surrounded by mountain basins up to 3,250 meters (10,500 feet) in elevation (USFWS 1998). This species is always found in association with another grassland species, the prairie dog (*Cynomys* spp.; Burt and Grossenheider 1980, Cahalane 1954). Prairie dogs are the principle food of the black-footed ferret, and prairie dog burrows provide the ferret's principle shelter. Research has found that the black-footed ferret is more than just associated with the prairie dog, but is truly obligate and dependent upon this rodent for its survival as a species (Anderson et al. 1986, Biggins et al. 1986, Clark 1989, Forrest et al. 1988, Henderson et al. 1974, Hillman 1968, Miller et al. 1996). Data suggest that a ferret needs a prairie dog colony of at least 12.5 hectares (31.3 acres) to survive for a year and a minimum of 50 hectares (125 acres) to raise a litter (Caughley and Gunn 1996). Ferret range is coincident with that of prairie dogs (Anderson et al. 1986). There is no documentation of black-footed ferrets breeding outside of prairie dog colonies. Specimen records of black-footed ferrets are available from ranges of three species of prairie dogs: black-tailed prairie dog (*Cynomys ludovicianus*), white-tailed prairie dog (*Cynomys leucurus*), and Gunnison's prairie dog (*Cynomys gunnisoni*; Anderson et al. 1986).

Major causes for the decline in this species are long-term prairie dog control efforts, the loss of habitat as a result of destruction of original grasslands, and canine distemper (Frey and Yates 1996). Recovery plans were approved in June 1978 and August 1988. These included captive breeding and release to protected habitats in the wild.

4.1.1.2 Distribution

Historically, this species' range included New Mexico, Arizona, Colorado, Utah, Kansas, Oklahoma, Texas, Wyoming, Nebraska, Montana, North Dakota, South Dakota, Alberta, and Saskatchewan. It was decimated from all of its former range, and distribution is now limited to introduced populations in Arizona, Wyoming, Montana, and South Dakota (USFWS 1998). Reintroduction efforts have been concentrated in these four states because they still have protected areas with large prairie dog colonies. Although the Wyoming effort has been hampered by disease problems, the other three states have shown some success (USFWS 1996). Reintroduction efforts began in 1991 in Wyoming, 1994 in Montana and South Dakota, and 1996 in Arizona.

4.1.1.3 Status in the Project Area

Based on surveys conducted to date, black-footed ferrets are not known to occur in the project area. However, one of the potential black-footed ferret reintroduction sites recommended by the Montana Black-Footed Ferret Coordinating Committee is located within the project area in Custer County. If a proposal is made by the USFWS and the Montana Department of Fish, Wildlife and Parks (MFWP) to reintroduce the black-footed ferret in this area, further coordination to avoid impacts will be required.

4.1.1.4 Project Impact

Black-footed ferrets are exclusively found associated with their main prey species: prairie dogs. Prairie dogs are found throughout the project area. Any activity affecting prairie dog colonies has the potential to impact the ferret.

4.1.1.5 Conservation Measures

Two BLM leasing stipulations address black-footed ferret concerns. The first states that exploration in prairie dog colonies within potential black-footed ferret reintroduction areas comply with the Draft *Guidelines for Oil and Gas Activities in Prairie Dog Ecosystems Managed for Black-footed Ferret Recovery* (USFWS 1990). Compliance with these guidelines is required, and they specify that

conditions of approval depend on the type and duration of the proposed activity, proximity to occupied ferret habitat, and other site-specific conditions. Exceptions or waivers of this stipulation may be granted if the Montana Black-Footed Ferret Coordination Committee determines the proposed activity would have no adverse impacts on ferret reintroduction or recovery. The second stipulation requires all prairie dog colonies or complexes greater than 80 acres in size be surveyed for black-footed ferret absence or presence prior to ground disturbance. The results of the survey determine whether restrictions or denial of use are appropriate for the site. Both of these stipulations will be implemented under the proposed action.

4.1.1.6 Determination

Provided strict adherence to BLM leasing stipulations, the proposed action will result in a "may affect, not likely to adversely affect" situation for black-footed ferrets.

4.1.2 CANADA LYNX (*LYNX CANADENSIS*)

4.1.2.1 Habitat

This species was listed as threatened on March 24, 2000. In the contiguous United States, the distribution of the lynx is associated with the southern boreal forest, comprised of subalpine coniferous forest in the West, and primarily mixed coniferous/deciduous forest in the East (Aubry et al. 1999); whereas in Canada and Alaska, lynx inhabit the classic boreal forest ecosystem known as the taiga (McCord and Cardoza 1982, Quinn and Parker 1987, McKelvey et al. 1999). Within these general forest types, lynx are most likely to persist in areas that receive deep snow, for which the lynx is highly adapted (Ruggiero et al. 1999).

According to the USFS (1993), lynx require three primary habitat components:

1. Foraging habitat (15- to 35-year-old lodgepole pine (*Pinus contorta*) to support snowshoe hare, the primary food source, and provide hunting cover).
2. Denning sites with patches of spruce and fir greater than 200 years old and generally smaller than 5 acres.
3. Dispersal and travel cover that is variable in vegetative composition and structure.

Abundance of snowshoe hare is the limiting factor for lynx. The hare is limited by the availability of winter habitat that includes early successional lodgepole pine with trees at least 6 feet tall.

4.1.2.2 Distribution

In the western United States, lynx historically occurred in the Cascades Range of Washington and Oregon; and the Rocky Mountain Range in Montana, Wyoming, Idaho, eastern Washington, eastern Oregon, northern Utah, and Colorado (McCord and Cardoza 1982, Quinn and Parker 1987).

4.1.2.3 Status in the Project Area

The range of lynx includes portions of four counties within the project area: Wheatland, Sweet Grass, Stillwater, and Carbon (MFWP 2006). Within this area, lynx are expected to occur within suitable subalpine coniferous forests and moist Douglas fir forests, especially those areas with dense, old growth providing lynx forage and denning areas, as well as young, dense forested stands providing lynx forage. The project area does not contain areas proposed by USFWS as critical lynx habitat (USFWS 2005a).

4.1.2.4 Project Impact

Although possible, exploration and development of CBNG are not expected to occur in higher elevation forests providing lynx habitat. If exploration or associated roads or utility lines were constructed within lynx habitat, the animals could be impacted by habitat loss and by disturbance.

4.1.2.5 Conservation Measures

Any drilling pads or other construction areas (e.g., road and utility line construction) located in suitable high elevation forested areas, especially areas with populations of hares or rabbits, would be surveyed prior to ground disturbance for scat and individuals following established protocols. If found, the site would be avoided and surrounded by a buffer zone as recommended by USFWS biologists.

4.1.2.6 Determination

Implementation of conservation measures will result in a "may affect, not likely to adversely affect" situation for Canada lynx.

4.1.3 GRAY WOLF (*CANIS LUPUS*)

4.1.3.1 Habitat

This species was listed as endangered on March 11, 1967, and is currently listed as endangered/experimental, non-essential in Montana. However, USFWS has recently concluded that delisting gray wolves in the Northern Rocky Mountains may be warranted (USFWS 2005b). The gray wolf can be found in any area, within their current range, that supports populations of hoofed mammals (ungulates), its major food source.

4.1.3.2 Distribution

The wolf was considered extirpated from the western portion of the conterminous United States by about 1930. The gray wolf is native to most of North America north of Mexico City, except for the southeastern United States, where a similar species, the red wolf (*Canis rufus*), was found. The gray wolf occupied nearly every area in North America that supported populations of hoofed mammals (ungulates). The gray wolf occurred historically in the northern Rocky Mountains, including mountainous portions of Wyoming, Montana, and Idaho. For 50 years prior to 1986, no detection of wolf reproduction was found in the Rocky Mountain portion of the United States.

A revised recovery plan for the Northern Rocky Mountain states (Montana, Wyoming, Idaho) was approved by USFWS in 1987 (USFWS 1987). It identified a recovered wolf population as being at least 10 breeding pairs of wolves, for 3 consecutive years, in each of three recovery areas (Central Idaho, Greater Yellowstone, and Northwestern Montana). A population of this size would be comprised of about 300 wolves. The plan recommended natural recovery in Montana and Idaho. The plan recommended use of ESA section 10(j) authority to reintroduce experimental wolves. By establishing a nonessential experimental population, more liberal management practices could be implemented to address potential negative impacts or concerns regarding the reintroduction. The final EIS was filed with the EPA on May 4, 1994, and the notice of availability was published on May 9, 1994. The EIS considered five alternatives: 1) Reintroduction of Wolves Designated as Experimental; 2) Natural Recovery (No Action); 3) No Wolves; 4) Wolf Management Committee Recommendations; and 5) Reintroduction of Wolves Designated as Non-experimental. After careful review, the USFWS proposed to reintroduce nonessential experimental gray wolves in Yellowstone Park and central Idaho. Wolves in the third recovery area, the Northwest Montana Recovery Area encompassing northwest Montana and the Idaho Panhandle, are covered fully by the ESA as endangered species. Under the Experimental Population Final Rule guidelines from 1994, 35 wolves were introduced into central Idaho and 66 wolves were introduced into Yellowstone National Park in 1995 and 1996.

In recent years, wolves in the Northern Rocky Mountain states have continued to increase in distribution and numbers, and recovery criteria have been met for removing Northern Rocky Mountain wolves from the Endangered Species list (USFWS et al. 2005). Estimates of wolf numbers at the end of 2004 were 452 wolves in the Central Idaho Recovery Area, 324 wolves in the Greater Yellowstone Recovery Area, and 59 in the Northwest Montana Recovery Area.

4.1.3.3 Status in the Project Area

Wolves in the project area vicinity are part of the experimental population originally introduced into Yellowstone Park. The most recent Rocky Mountain Wolf Recovery Annual Report estimates the population size of the experimental wolf population in southern Montana at 94 wolves (USFWS et al. 2005). The range of the Moccasin Lake, Phantom Lake, Red Lodge, and Beartooth wolf packs occur within, or partially within, the project area (USFWS et al. 2005). There are no active wolf den or rendezvous sites known to occur within the project area. However, the Red Lodge pack likely has a den site somewhere in the Red Lodge vicinity (Trapp, personal. comm. 2006).

4.1.3.4 Potential Impact

Roads and the presence of humans would increase the threat from shooting, either intentionally or accidentally (if mistaken for a coyote). The density of roads in occupied wolf areas could force wolves from occupied areas and could increase stress on wolves and result in the loss of some individuals.

4.1.3.5 Conservation Measures

Prior to construction on project area lands in counties where wolves are most likely to occur (Carbon, Stillwater, and Sweet Grass counties currently, with potential for additional counties in the future if wolves expand their range), surveys would include specific searches for this animal, occupied dens, or scat. If wolves or other wolf indicators were found, USFWS would be consulted and proper protocols

followed. Likely protocols include providing buffers around wolf den and rendezvous sites and limiting road density in areas of occupied wolf habitat.

4.1.3.6 Determination

Implementation of conservation measures will result in a "not likely to jeopardize" situation for this experimental/non-essential gray wolf population.

4.1.4 GRIZZLY BEAR (*URSUS ARCTOS HORRIBILIS*)

4.1.4.1 Habitat

This species was listed as endangered on March 11, 1967. This status was changed to threatened on July 28, 1975. On November 11, 2000, the USFWS listed some populations in Montana and Idaho as experimental to facilitate restoration to designated recovery areas. On June 20, 2001, Interior Secretary Gale Norton rescinded the plans for restoration and withdrew a plan to reintroduce grizzly bears into the Bitterroot ecosystem of Idaho and Montana. Current status for this species is threatened, although the Yellowstone distinct population segment (DPS) of grizzly bears has been proposed for delisting (USFWS 2005c).

The grizzly (or brown) bear was once found in a wide variety of habitats including open prairie, brushlands, riparian woodlands, and semidesert scrub. Most populations require vast areas of suitable habitat to prosper. They forage for wild fruits; nuts; bulbs; roots; insect larvae in logs; and carcasses of elk, deer, and cattle (Graham 1978, Mealey 1975, Schleyer1983). This species is common only in habitats where food is abundant and concentrated, including white-bark pine, berries, and salmon or cutthroat runs, and where conflicts with humans are minimal (Reinhart 1990, Podruzny1999). Research indicates it is important to maintain areas where grizzly bears can forage for a 24- to 48-hour period secure from human disturbance (Gibeau et al. 1996).

Winter dens are dug in north-facing slopes or more often at the base of large trees in areas away from humans in late fall or winter after snow has begun to fall (Crowed and Crowed 1972, Jonkel 1980, Judd et al. 1986,Vroom et al. 1980).

4.1.4.2 Distribution

This species once lived in a variety of habitats across most of North America. Grizzly bears now occupy only 2 percent of their original range in the lower 48 states in remote wilderness areas in Idaho, Montana, Wyoming, Alaska, and Washington.

4.1.4.3 Status in the Project Area

The current range of grizzly bears extends into the southwestern portion of the project area (Map 2). These bears are part of the Yellowstone grizzly bear DPS. On November 15, 2005, the USFWS announced this DPS is a recovered population, no longer meeting the ESA's definition of threatened or endangered, and consequently, the USFWS proposed to delist this DPS (USFWS 2005c). The Yellowstone grizzly bear DPS increased from estimates as low as 136 individuals when listed in 1975 to more than 580 animals as of 2004. The population has been increasing since the mid 1990s and is increasing at 4 to 7 percent per year. The range of this population also has increased dramatically as evidenced by the 48-percent increase in occupied habitat since the 1970s (USFWS 2005c).

None of the areas that may potentially be developed for CBNG occur within the Yellowstone grizzly bear recovery zone, and approximately 550 acres of BLM-administered coal or oil/gas/coal estate occur within occupied grizzly bear habitat outside the recovery zone (Map 2).

4.1.4.4 Potential Impact

Roads and the presence of humans would increase the risk of human-bear interactions, which occasionally end in the death of the grizzly bear. The increase in density of roads in occupied grizzly bear areas could force the bears from these areas and could increase stress on the bears, resulting in the potential loss or reduced fecundity of some individuals.

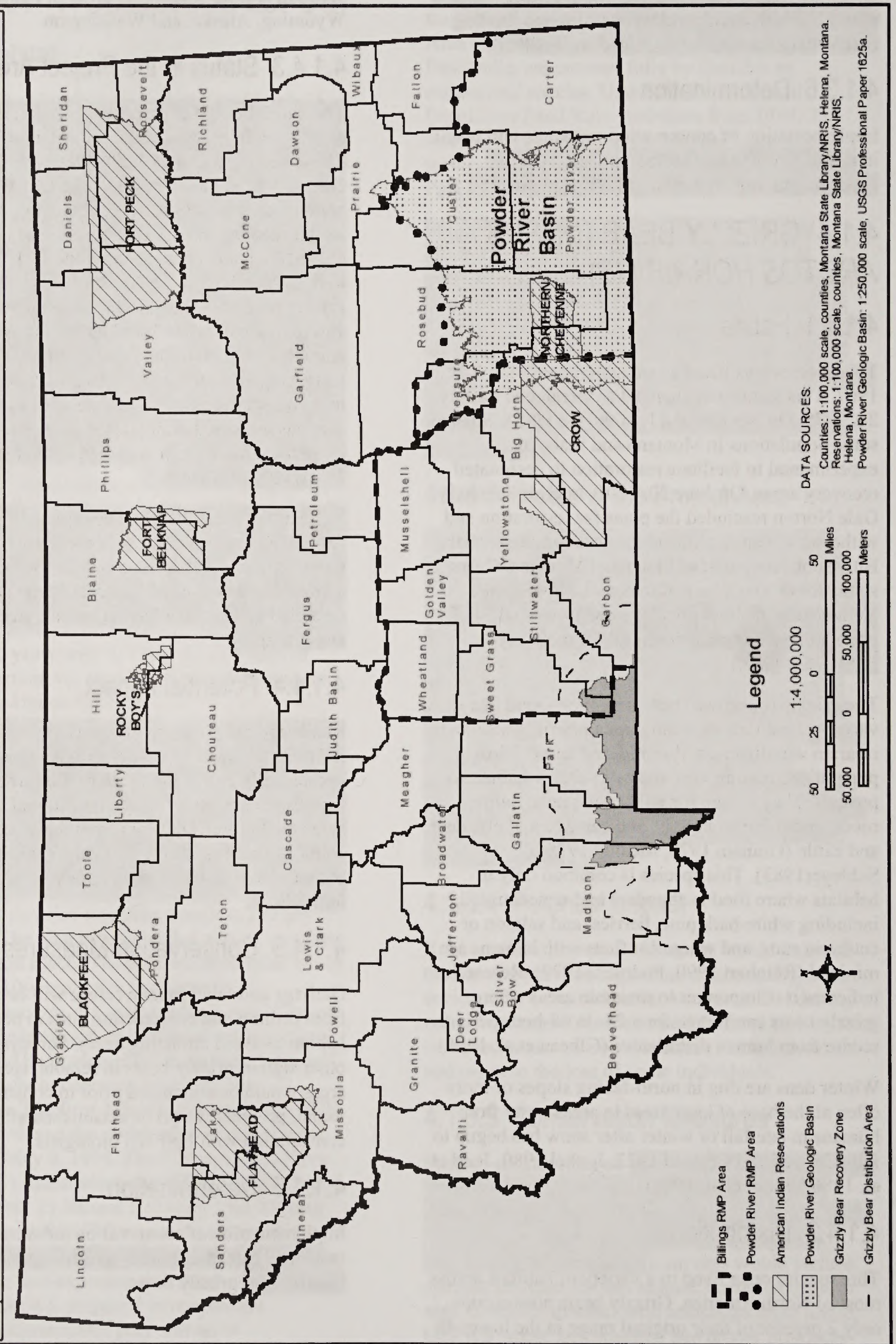
4.1.4.5 Conservation Measures

Garbage and other human refuse will be removed from drilling and construction sites in potential bear habitat to avoid attracting bears. Surveys for scat and other sign of grizzly bears in remote, sparsely roaded areas would be conducted prior to construction. If found, protocol would be established after consultation with USFWS biologists.

4.1.4.6 Determination

Implementation of conservation measures will result in a "may affect, not likely to adversely affect" situation for grizzly bears.

Map 2: CBNG PLANNING AREA AND THE YELLOWSTONE GRIZZLY BEAR RECOVERY ZONE



4.2 Birds

4.2.1 BALD EAGLE (*HALIAEETUS LEUCOCEPHALUS*)

4.2.1.1 Habitat

This species was reclassified from endangered to threatened, because of recovery status, on July 12, 1995. Due to continued recovery and increase in population size, the USFWS proposed the bald eagle be delisted (USFWS 1999).

Bald eagles concentrate in and around areas of open water where waterfowl and fish are available. They prefer solitude; late-successional forests; shorelines adjacent to open water; a large prey base for successful brood rearing; and large, mature tree for nesting and resting (Fisher et al. 1998).

4.2.1.2 Distribution

The bald eagle ranges throughout much of North America, nesting on both coasts from Florida to Baja California, Mexico in the south, and from Labrador to the western Aleutian Islands, Alaska in the north. An estimated one-quarter to one-half million bald eagles lived on the North American continent before the first Europeans arrived. Nationwide bald eagle surveys, conducted in 1973 and 1974 by the USFWS, other cooperating agencies, and conservation organizations, revealed that the eagle population throughout the lower 48 states was declining. A partial survey conducted by the National Audubon Society in 1963 reported on 417 active nests in the lower 48 states, with an average of 0.59 young produced per nest. Surveys coordinated by USFWS in 1974 resulted in a population estimate of 791 occupied breeding areas for the lower 48 states. The USFWS estimated that the breeding population exceeded 5,748 occupied breeding areas in 1998. The bald eagle population has essentially doubled every 7 to 8 years during the past 30 years.

4.2.1.3 Status in the Project Area

Bald eagles nest along all the major rivers within the project area. These watersheds provide important habitat during spring and fall migrations, as well as during the winter months. Bald eagles have been expanding their nesting territories throughout south-central and southeastern Montana (Flath 1991).

4.2.1.4 Project Impact

Bald eagles are sensitive to human presence. Disturbance to foraging, resting, roosting, or migrating eagles is possible through surface use in other areas not addressed by stipulations. Stipulations listed in the introduction of the Wildlife section (Chapter 4 Wildlife) in the Powder River and Billings Amendment to the RMPs and SEIS, including no surface use or occupancy within 0.5 mile of nests active in the last 7 years and within riparian area nesting habitat. It is assumed these stipulations would prevent eagles from abandoning traditional nesting sites in the project area, but periodic or complete abandonment of non-nesting habitat may occur depending on the level of human use and noise. Removal of large trees in wintering areas, particularly at established roost sites, could also displace bald eagles by removing perch and roost sites.

Regarding oil and gas infrastructure, above-ground transmission facilities will not likely result in the death of bald eagles from electrocution because of proper design and construction requirements. Utility lines and motor vehicles do however pose strike hazards for bald eagles, especially near perennial rivers and water bodies that support fish and waterfowl. For powerlines, the operator will demonstrate in the Project POD how the proposal for power distribution would mitigate or minimize impacts to affected wildlife. For example, the operator may propose that all or a portion of the powerlines be buried and any aboveground lines be designed following raptor-safe specifications. Additionally, for each proposed CBNG development, operators will document in the Project POD the surface owner consultation process and input received for the location of roads, pipelines, and utility line routes.

4.2.1.5 Conservation Measures

Prior to CBNG development or construction, a wildlife biologist will survey the construction zone within a 1.0-mile width for bald eagles and bald eagle nests. Surface occupancy and use will be prohibited within 0.5 mile of any identified nest or riparian nesting habitat. Surveys for bald eagle winter roost sites will be conducted during winter/spring along wooded riparian corridors within 1.0 mile of proposed CBNG development. Surface occupancy will be prohibited within 0.5 mile of any identified bald eagle roost site. Specifications to minimize the effects of roads, pipelines, and utility line routes on bald eagles are described in Section 4.2.1.4.

4.2.1.6 Determination

Implementation of the conservation measures will result in "may affect, not likely to adversely affect" situation for bald eagles.

4.2.2 INTERIOR LEAST TERN (*STERNA ANTILLARUM ATHALASSOS*)

4.2.2.1 Habitat

This species was listed as endangered on May 28, 1985.

The occurrence of breeding least terns is localized and depends upon the presence of dry, exposed sand bars and favorable river flows that support desired forage fish and that also isolate the sand bars from the river banks. Characteristic riverine nesting sites are dry, flat, sparsely vegetated sand and gravel bars within a wide, unobstructed, water-filled river channel (Ziewitz et al. 1992). The sand at a nesting site must be mostly clear of vegetation, and water levels low enough for nests to remain dry. Nests are initiated only after spring and early summer flows recede and dry areas on sand bars are exposed, usually on higher elevations away from the water's edge. Artificially created nesting sites, such as sand and gravel pits, dredge islands, reservoir shorelines and power plant ash disposal areas, also are used occasionally as well (Kirsch 1996).

4.2.2.2 Distribution

The interior least tern is migratory and historically bred along the Mississippi, Red, and Rio Grande River systems and rivers of central Texas. The breeding range extended from Texas to Montana and from eastern Colorado and New Mexico to southern Indiana. It included the Red, Missouri, Arkansas, Mississippi, Ohio, and Rio Grande river systems. The interior least tern continues to breed in most of the aforementioned river systems, although its distribution generally is restricted to less altered river segments (USFWS 2006a).

4.2.2.3 Status in the Project Area

The least tern is known to nest in the project area and also occasionally may pass through the area during spring and fall migration. Its habitat in the project area includes graveled islands in the lower Yellowstone River (Fisher et al. 1998).

4.2.2.4 Project Impact

This species is susceptible to disturbance during the nesting period. It is highly vulnerable to changes in water levels during the nesting period.

4.2.2.5 Conservation Measures

Potential habitat near drilling and construction sites will be identified and appropriate surveys will be conducted for this species. Surface occupancy and use will be prohibited within 0.25 mile of wetlands identified as providing interior least tern nesting habitat. Occupied wetlands and water levels will be protected in all phases of drilling and construction and no discharge into occupied wetlands will be permitted.

4.2.2.6 Determination

With strict adherence to survey protocols, stipulations and conservation measures, the proposed action will have "no effect" on interior least terns.

4.2.3 Whooping Crane (*Grus americana*)

4.2.3.1 Habitat

The whooping crane was first listed as endangered on March 11, 1967, and the listing was "grandfathered" into the ESA. Whooping cranes nest in marshy areas among bulrushes, cattails, and sedges that provide protection from predators as well as food (USFWS 2006b). During the nesting season, the birds feed and roost in wetlands and upland grain fields, where they associate with ducks, geese, and sandhill cranes. Whooping cranes use a variety of habitats during migration, including croplands for feeding and large palustrine (marshy) wetlands and riverine habitats for roosting. About 9,000 hectares of salt flats in the Aransas National Wildlife Refuge (NWR) and adjacent islands comprise the principal winter grounds.

4.2.3.2 Distribution

Wild populations of whooping cranes utilize the Texas Gulf coast, including Aransas NWR, Texas, and Bosque del Apache NWR, New Mexico, and migration and staging areas through northeastern Montana, the western half of North Dakota, central South Dakota, Nebraska, Oklahoma, and east-central Texas (USFWS 2006b). In addition, a non-migratory whooping crane population resides in Florida (USFWS 2006b). For the past 20 years, observations

in Montana have been restricted to the northeast corner of the state (MFWP 2006). The birds observed in this area represent occasional migrants traveling through from the Aransas population on journey to the breeding grounds in Alberta and the Northwest Territories. As of January 2005, the wild population of whooping cranes was estimated at approximately 300 individuals (USFWS 2005d).

4.2.3.3 Status in the Project Area

Whooping cranes have not been sighted within the project area within the past 20 years (MFWP 2006). Any birds that may use the area would only occur as transients passing through the area during migration.

4.2.3.4 Project Impact

Whooping cranes are very occasional migrants in southeast and south central Montana, and there are no known stop-over habitats within the project area. As migrants, whooping cranes would only be affected by very tall structures, such as large transmission lines and towers, communication towers and guy-wires, and similar structures which represent potentials for in-flight collisions. There are no such tall structures proposed in this project.

4.2.3.5 Conservation Measures

There are no ancillary structures and facilities proposed in the project area which would present a potential for in-flight collision for whooping cranes. The on-site electric distribution lines are all relatively low, and many lines will be buried to further reduce the potential for collision.

4.2.3.6 Determination

Implementation of the conservation measures would result in "no effect" to whooping cranes.

4.3 Fish

4.3.1 PALLID STURGEON (*SCAPHIRHYNCHUS ALBUS*)

4.3.1.1 Habitat

This species was listed as endangered on September 6, 1990 (55 FR 36641). They are found in large rivers with high turbidity and a natural flow with rocky or sandy substrates (Forbes and Richardson 1905). They evolved in large rivers with high turbidity and a natural hydrograph that included spring flooding and other high runoff events. Preferred habitat has a diversity of depths and velocities formed by braided channels, sandbars, islands, sand flats and gravel bars (Erickson 1992, Gilbraith et al. 1988). Pallid sturgeon are usually found now in deeper holes below sandbars and in riverine reaches of reservoirs (Kallemeyn 1983, Erickson 1992, Clancey 1991).

4.3.1.2 Distribution

Historically, pallid sturgeon were found in the Missouri River from Fort Benton, Montana, to St. Louis, Missouri; in the Mississippi River from above St. Louis to the Gulf of Mexico; in the lower reaches of other large tributaries, such as the Yellowstone, Platte, Kansas, Ohio, Arkansas, Red, and Sunflower Rivers; and in the first 60 miles of the Atchafalaya River (Bailey and Cross 1954, Kallemeyn 1983).

4.3.1.3 Status in the Project Area

Historically in Montana, pallid sturgeon occupied reaches of the Missouri River from Fort Benton downstream and in the Yellowstone River from about Forsyth (river mile 183) to the Missouri River (USFWS 1993, Montana Natural Resource Information System 2005). Natural water flow and natural flooding events have been changed by channel developments and hydroelectric projects. These changes, coupled with pollution and fishing, are believed to be the main reason for the decline in this species. There are two pallid sturgeon recovery priority management areas (RPMAs) in Montana, with one (RPMA 1) located upstream of Fort Peck Dam on the Missouri River, and the other (RPMA 2) including the Missouri River reach downstream of Fort Peck Dam and the lower Yellowstone River (upstream to the mouth of the Tongue River). Thus, portions of the Project Area occur in RPMA 2. While the lower Yellowstone River is believed to support relatively high survival of hatchery-reared pallid sturgeon, no known recruitment has occurred in the Yellowstone River for at least 30 years. Thus this species will likely be extirpated from this area by 2018 (Jaeger et al. 2005).

4.3.1.4 Project Impact

There could be minimal, temporary effects through construction of stream crossings and erosion generated by construction activities. The proposed action contains requirements designed to protect hydrologic resources by combining management options of CBNG-produced water so that no degradation of water quality would be allowed in any watershed. CBNG operators would be required to develop a Water Management Plan as part of their overall Project POD that describes how impacts on surface resources would be minimized or mitigated,

and how a discharge (if proposed by the operator) could occur without damaging the watershed—in accordance with a required and approved NPDES Permit and water quality laws. Stipulations prohibiting surface occupancy or use of water bodies, floodplains of major rivers, riparian areas, and steep slopes would further avoid impacts. These measures would avoid water quality impacts to the pallid sturgeon. In addition, release of adequate quality water from production may improve habitat that has been degraded through water withdrawals.

The Water Management Plans would also establish site-specific thresholds for the volume of untreated produced water that could be discharged to surface waters from federal CBNG wells. These requirements would be in addition to the surface water quality and discharge volume limitations stipulated in the Montana Pollutant Discharge Elimination System (MPDES) discharge process. The total allowable untreated discharge volume would be based on 10 percent of the 7Q10 flow rate, unless specific surface water quality monitoring is conducted upstream and downstream of the particular outfall. If monitoring indicates that water quality thresholds would be exceeded, no further untreated discharge would be allowed, regardless of the total discharge volume to the water body.

Long-term effects on pallid sturgeon associated with discontinued activities, such as sediment delivery from roads, would subside as disturbed areas are reclaimed. Agency mitigation measures implemented during abandonment would reduce erosion potential, prevent water pollution, facilitate reclamation of disturbed lands, and further reduce the potential for long-term impacts on pallid sturgeon.

4.3.1.5 Conservation Measures

There are no specific conservation measures identified; however, the BLM will develop, include, and enforce appropriate mitigation measures for aquatic resources, including pallid sturgeon, during the site-specific, plan-approval stage. Measures to further avoid or reduce impacts in addition to those included at the plan-approval stage may be recommended. The state will apply additional mitigation measures on a case-by-case basis through the use of field rules.

4.3.1.6 Determination

If conservation measures are implemented, this project "may affect but is not likely to adversely affect" pallid sturgeon.

4.3.2 MONTANA ARCTIC GRAYLING (*THYMALLUS ARCTICUS Montanus*)

4.3.2.1 Habitat

This species is currently a candidate for listing under the ESA. On October 2, 1991, a petition requested that the "fluvial Arctic grayling" be listed as an endangered species throughout its historic range in the lower 48 states. The petitioners stated that the decline of the fluvial Arctic grayling was a result of many factors, including habitat degradation from domestic livestock grazing and stream diversions for irrigation, competition with non-native trout species, and past over-harvesting by anglers. Additionally, the petition stated that much of the annual recruitment is lost in irrigation ditches.

4.3.2.2 Distribution

Historically, the fluvial Arctic grayling DPS occurred throughout the streams and rivers of the upper Missouri River drainage, above Great Falls Montana (USFWS 2005e). However, the current distribution is estimated to represent about 5 percent of this historic range. While the lake-dwelling form is fairly common in 30 or more lakes across the western half of the state, the native fluvial or river-dwelling population is believed restricted to the upper Big Hole River.

4.3.2.3 Status in the Project Area

In Montana, Arctic grayling are generally found at relatively high and cold headwater locations. Within the project area these locations include headwaters in the Clarks Fork of the Yellowstone River. However, studies by the MFWP show that the relative abundance of grayling in this area is "rare" (Montana Natural Resource Information System 2005).

4.3.2.4 Project Impact

There could be minimal, temporary effects through construction of stream crossings and erosion generated by construction activities. The proposed action contains requirements designed to protect hydrologic resources by combining management options of CBNG-produced water so that no degradation of water quality would be allowed in any watershed. CBNG operators would be required to develop a Water Management Plan as part of their overall Project POD that describes how impacts on surface resources would be minimized or mitigated,

and how a discharge (if proposed by the operator) could occur without damaging the watershed—in accordance with a required and approved NPDES Permit and water quality laws. Stipulations prohibiting surface occupancy or use of water bodies, floodplains, riparian areas, and steep slopes would further avoid impacts. These measures would avoid water quality impacts to the Arctic grayling. In addition, release of adequate quality water from production may improve habitat that has been degraded through water withdrawals.

The Water Management Plans would also establish site-specific thresholds for the volume of untreated produced water that could be discharged to surface waters from federal CBNG wells. These requirements would be in addition to the surface water quality and discharge volume limitations stipulated in the MPDES discharge process. The total allowable untreated discharge volume would be based on 10 percent of the 7Q10 flow rate, unless specific surface water quality monitoring is conducted upstream and downstream of the particular outfall. If monitoring indicates that water quality thresholds would be exceeded, no further untreated discharge would be allowed, regardless of the total discharge volume to the water body.

Long-term effects on Arctic grayling associated with discontinued activities, such as sediment delivery from roads, would subside as disturbed areas are reclaimed. Agency mitigation measures implemented during abandonment would reduce erosion potential, prevent water pollution, facilitate reclamation of disturbed lands, and further reduce the potential for long-term impacts on Arctic grayling.

4.3.2.5 Conservation Measures

There are no specific conservation measures identified; however, the BLM will develop, include, and enforce appropriate mitigation measures for aquatic resources, including Arctic grayling, during the site-specific, plan-approval stage. Measures to further avoid or reduce impacts in addition to those included at the plan-approval stage may be recommended. The state will apply additional mitigation measures on a case-by-case basis through the use of field rules.

4.3.2.6 Determination

As this species is not expected to occupy areas where CBNG activities are likely to occur, along with the implementation of appropriate best management practices (BMPs) and conservation measures, the proposed action is not "likely to significantly affect Arctic grayling populations, individuals, or their suitable habitat."

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Attachment A

Letter from USFWS with Species of Concern

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U.S. Fish and Wildlife Service 1987. Northern Rocky Mountain wolf recovery plan. Denver, Colorado. 119 pp.

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M.02 BLM Coal Bed Methane November 4, 2005

Ms. Julie Grialou
Wildlife Biologist
Parametrix
411 108th Avenue NE, Suite 1800
Bellevue, WA 98004-5571

Dear Ms: Grialou:

This responds to your letter received in the Billings Sub Office on September 23, 2005, requesting an updated species list for the preparation of a Biological Assessment. The Bureau of Land Management (BLM), Miles City Field Office, is preparing a Supplemental Environmental Impact Statement (SEIS) for the Montana Statewide Oil and Gas EIS and Amendment of the Powder River and Billings Resource Management Plans.

The planning area for the SEIS is located in southeastern and south-central Montana, including Treasure, Powder River, Wheatland, Golden Valley, Musselshell, Sweet Grass, Stillwater, Yellowstone, Big Horn, Carbon Counties, as well as portions of Carter, Custer, and Rosebud counties.

In accordance with section 7(c) of the Endangered Species Act of 1973, as amended (Act), my staff has determined that the following threatened or endangered species, or species proposed for listing under the Act, may be present in the project area.

Listed Species	**Status**	**Expected occurrence**
Black-footed Ferret (*Mustela nigripes*)	E/XN	Prairie dog complexes; Eastern Montana
Gray Wolf (*Canis lupus*)	T/XN	Forests; Western Montana
Grizzly Bear (*Ursus arctos horribilis*)	T	Alpine/subalpine coniferous forest; western Montana

Canada Lynx (*Lynx canadensis*)	T	Montane spruce/fir forest; western Montana
Whooping Crane (*Grus Americana*)	E	Wetlands, croplands; transient statewide
Least Tern (*Sterna antillarum*)	E	Yellowstone, Missouri River sandbars, beaches; Eastern Montana
Pallid Sturgeon (*Scaphirhynchus albus*)	E	Bottom dwelling; Missouri, Yellowstone Rivers
Bald Eagle (*Haliaeetus leucocephalus*)	T	Forested riparian; statewide

Pursuant to Section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.), the BLM, as the responsible Federal agency, must determine if the proposed actions may affect these listed species and if so, initiate formal consultation with the Fish and Wildlife Service (Service). Guidance for preparation of a biological assessment for the *2002 Montana Statewide Draft Oil and Gas Environmental Impact Statement (EIS) and Amendment of the Powder River and Billings Resource Management Plans* (RMPs), was provided to the BLM by the Service in a letter dated April 2001. Comments on the Draft Oil and Gas Environmental Impact Statement (DEIS) were provided to the BLM's Miles City office in a memorandum dated May 15, 2002.

We also recommend that Parametrix utilize information and data gathered by federal and state agencies that comprise the Powder River Basin Coal Bed Natural Gas Interagency Working Group and Task Groups; and monitoring through the implementation of a *Coal Bed Methane Programmatic Wildlife Monitoring and Protection Plan for the Statewide Oil and Gas Environmental Impact Statement and Amendment of the Powder River and Billings Resource Management Plans* (Wildlife Monitoring Protection Plan) in determining the impacts of the BLM's action on listed and proposed species. The new determination should include possible downstream effects on the pallid sturgeon and least tern.

The Service also advocates that the BLM considers a spatio-temporal based alternative in its analysis of the effects of coal bed methane production on listed and proposed species as outlined in comments made by our biologist involved the DEIS development process. A spatio-temporal alternative would open some area for development and production while leaving other areas free from production until reclamation activities have been completed on earlier phases.

The effects of high-intensity Coal Bed Methane (CBM) development on fish and wildlife resources are largely unknown, but are suspected to reduce the utility of habitat for some species, including listed species and those on the BLM sensitive species list. Species will vary in their

reaction to development, but it will affect how species utilize the landscape. There are currently ongoing studies in Wyoming and Montana that address questions about the effects of CBM development on a variety of species. When these studies are completed, we will have a better foundation on which to base conservation measures in planning this development, until then, it seems prudent to analyze a range of alternatives that includes one based on spatio-temporal phasing as a conservative approach that will have conservation benefits for species for which little in known.

If you have any questions regarding this letter, please contact Lou Hanebury at (406) 247-7367 or Shawn Sartorius at (406) 247-7369 in our Billings Sub Office. We appreciate your efforts to consider endangered species in your project planning.

Sincerely,

R. Mark Wilson
Field Supervisor
Montana Field Office

cc: USFWS, SO, MT (Attn: Lou Hanebury)
USFWS, FO, WY (Attn: Brad Rogers)
BLM, Miles City Office, MT (Larry Apple)